AD NUMBER
AD530744
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
FROM: Distribution authorized to U.S. Gov't. agencies only; Test and Evaluation; 25 JUL 1974. Other requests shall be referred to Chief, Office of Naval Research, Attn: Code 102-OS, Arlington, VA 22217.
AUTHORITY
ONR ltr, 31 Jan 2006; ONR ltr, 31 Jan 2006

AD- 530744

SECURITY REMARKING REQUIREMENTS

DOD 5200.1-R, DEC 78

REVIEW ON 21 NOV 93

SQUARE DEAL

R/V SEISMIC EXPLORER

FIELD OPERATIONS REPORT (U)

21 November 1973

Prepared by
SEISMIC ENGINEERING COMPANY
P. O. Box 22328
Houston, Texas 77027

Principal Investigator: Dr. R. R. Gardner, NUC
Program Manager: W. H. Luehrmann, SECo

Period Covered by Report: August - September 1973

This research was sponsored by Code 102-OSC
Long Range Acoustic Propagation Project,
Office of Naval Research, Contract #N00123-74-C-0523
and technical supervision was provided by
NAVAL UNDERSEAS CENTER
San Diego, California

NO. 7 OF 43 COPIES

TABLE OF CONTENTS

F I G U R E S

FIG #

FIGURES Continued

TABLES

S Q U A R E D E A L

P R E L I M I N A R Y R E P O R T (U)

SUMMARY:

(u) This report covers a portion of the data acquisition phase of a part of the 1973 SQUARE DEAL program of the Long Range Acoustic Propagation Project (LRAPP).

(c) Field operations were programmed for seven sites located in or near the narrow deep basin between Rockall Bank and Porcupine Bank in the eastern portion of the North Atlantic Ocean. These locations were occupied during the period 27 August to 5 September, at scheduled times, with the hydrophone array operated under "tow" and "stationary" (parachute modes). Record monitors indicate the data quality is excellent, and all required tasks were accomplished within the desired time frame and budget allocation, except as noted in this report.

(c) The objective of these events of SQUARE DEAL is to provide information concerning the azimuthal dependence of low-frequency ambient noise near the deep axis and along the shallow walls of the basin and to experimentally observe the signal-to-noise ratio and detectability of calibrated single-frequency tones originating from deep and shallow locations in the area.

(c) Selected, representative samples of the field digital noise records and the single frequency tone records will be prepared for computer processing and analysis. This will be specifically addressed in the subsequent studies.

INTRODUCTION:

(c) This report covers the data acquisition phase of specific events of the 1973 SQUARE DEAL program of the Long Range Acoustic Propagation Project (LRAPP). Field work was conducted in an area east of Rockall Bank as shown in Figure No. I. Stations were occupied during the period 27 August to 5 September 1973. SQUARE DEAL Exercise is further described in SQUARE DEAL Exercise Plan, MC Plan 012, May 1973.

(c) The objective of this portion of the project is to provide information concerning the azimuthal dependence of low-frequency ambient noise near the deep axis and along the shallow walls of the basin and to experimentally observe the signal-to-noise ratio and detectability of calibrated single-frequency tones originating from deep and shallow locations in the area. These data are to be acquired using a multi-element, geophysical prospecting type hydrophone streamer array operated under low speed tow and stationary (parachute) conditions.

(u) The geophysical array employed in this project consisted of 96 elements each containing 8 hydrophones spaced over a length of 12.5 meters. Between each active element was an inactive section of 12.5 meters resulting in a 25 meter spacing between active elements.

(u) SQUARE DEAL is sponsored by the Long Range Acoustic Propagation Project (LRAPP) and the Undersea Surveillance Project (PME-124) for the U.S.A. and by the Director of Naval Operational Requirements (DNO_R) for the U.K. Technical Responsibility is provided by LRAPP (Code 102-OSC, ONR) and the Admiralty Research Laboratory, Teddington, England. Technical Director for the U.S.A. is Dr. G. Raisbeck, Arthur D. Little, Inc., Cambridge, Massachusetts. Project technical supervision for this portion of the project was by the Undersea Surveillance and Ocean Sciences Department, Naval Underseas Center (NUC). Principal Investigator is Dr. R. R. Gardner (NUC) and the Senior Scientist on Board the M/V SEISMIC EXPLORER was Mr. H. S. Aurand.

(u) Subsequent reports will cover data reduction, analysis and interpretation of noise records.

(u) Seismic Engineering Company (SECo) was contracted to furnish a 96 section, 2400 meter long geophysical type hydrophone array. Facilities were provided for selecting any 48 of the total 96 elements of the array for recording. SECo also provided the array tow vessel, M/V SEISMIC EXPLORER, a 48 trace digital seismic recording system and certain other items necessary to conduct the field operations. SECo will also furnish technical support and computing facilities for processing and analysis of experimental data, plus field and final reports. R. W. Miller and F. D. Barnett supervised field operations.

(u) Field operations began on August 3, 1973, with mobilization of the M/V SEISMIC EXPLORER in Den Helder, Netherlands. Actual field data acquisition began on August 27, 1973, with the final data obtained on September 4, 1973. Vessel demobilization was completed in mid September in Den Helder.

(u) A Track Plot of the M/V SEISMIC EXPLORER as shown in Figure No. 2, Table II, presents a listing of all satellite position fixes obtained during the course of the exercise.

(c) Hydrophone array data acquisition was scheduled for seven sites in the Rockall Bank area of the eastern North Atlantic. Table I below, lists the geographical coordinates of each site and the operation scheduled. These sites are also shown in Figure No. 1.

TABLE I

(c) Site	Coordinates	Operation
2BC	54° 30' N, 13° 00' W	Array Calibration
2B	54° 09' N, 13° 04' W	Collapsed Polygon
2D	55° 12.8' N, 13° 33.1' W	Collapsed Polygon
2A	56°12.75' N, 14° 02' W	Collapsed Polygon
2F	57° 25' N, 11° 07' W	12-Sided Polygon
3QB	56° 39' N, 11° 07' W	Parachute Mode
3QD	54° 22' N, 15° 01' W	Parachute Mode

(c) The array calibration at site 2BC was made in conjunction with the USNS KINGSPORT, the signal source vessel, and the RMAS BULLFINCH, also towing an array. Vessel courses, starting times, etc. were decided by the SSOB on board each ship at the beginning of the procedure. At sites 2B, 2D, 2A and 2F precharted courses were run as close as wind and sea conditions permitted. The array was towed at a depth of 450 - 500 feet at a vessel speed of 3.5 - 4.0 knots. Site 3QB was not occupied due to extremely high winds and heavy seas. At site 3QD the array was deployed in the parachute mode at a depth of 500 feet. The vessel was powered down and operated as a "quiet ship". Array data in all cases were recorded digitally on a Texas Instruments DFS III, 48 trace, field seismic recorder.

(u) Navigation control was provided by Magnavox Satellite Navigation System on board the M/V SEISMIC EXPLORER. Location accuracy is approximately ± 600 feet at the satellite position fix locations. Positions between "fixes" were available through the dead reckoning portion of the system computer. These positions are only approximate and are dependent on the vessel speed and heading entered manually via the teleprinter.

(u) A total of 59 digital magnetic tape records were taken, each recording containing twelve minutes of data from the 48 array elements selected at the site. Additionally, various information including observers instrument operating reports, array orientation and configuration, ship sightings, and daily operational logs were kept.

(u) All stations were occupied within the alloted time frames except as noted. Field monitor records obtained during recording periods indicate high data quality for both tow and parachute modes. The project was completed on schedule and within budget.

(u) All data has been transmitted to SECo, Houston, Texas for reconstruction of vessel and array location, reduction of field logs and later computer analysis and interpretation.

(u) The sections to follow detail the equipment used and include a listing of all records.

VESSEL

(u) The recording and streamer array tow vessel was the M/V SEISMIC EXPLORER, owned and operated by SECo. Figures 3 and 4 show the overall vessel configuration as well as views of the array, depth controllers, and handling equipment.

(u) The SEISMIC EXPLORER was contracted from Stewart & Stevenson Services, Inc., Houston, Texas, and built at Mangone Shipyard, also in Houston. Construction was completed in September, 1967. The vessel was inspected by the U. S. Coast Guard and registered at the Port of Houston.

(u) The following details describe the vessel:

OFFICIAL NUMBER	511366
SIZE	165 ft. O.A. x 36 ft. beam x 15 ft. deep
GROSS TONNAGE	291.25
NET TONNAGE	198
NORMAL DRAFT	9 to 11 feet
CRUISING RANGE	10,000 miles
ACCOMMODATIONS	Five 4-man and three 2-man staterooms = 26 men
MAIN ENGINES	Two V-12 GM 567C
CONTINUOUS BHP, EACH	1120 @ 720 RPM
SPEED RANGE	3 to 15 knots
GENERATORS	Two GM 871, 100 KW ea.
AUTO PILOT	Sperry Gryo Pilot
GYRO COMPASS	Sperry Mark 14 Model 1
RADAR	Decca RM 329 with 9 ft. antenna
RADIO	23 Channel Northern N539L
RADIO CALL SIGN	WR-8350
FATHOMETERS	Two Simrad 512 - 15 WL

SEISMIC ARRAY

(u) The seismic streamer configuration used in this test is one from a series of marine streamers engineered and fabricated by Seismic Engineering Company for petroleum exploration. It contains Seismic's patented Multidyne ™ acceleration cancelling hydrophone elements which contribute to a superior signal to noise ratio in the seismic pass band. Over 100,000 Multidyne ™ hydrophone elements are now in streamers being used for oil exploration. Special deep water Multidyne ™ elements have recently been built for streamers on several classified Navy projects. An article describing the Multidyne ™ hydrophone, explaining the operating principles and showing results of several independent company field evaluations was published in the November, 1972 Geophysical issue of THE OIL & GAS JOURNAL.

(u) The 96 channel streamer used for SQUARE DEAL consisted of 1,000 feet of "faired" lead-in cable, two 200 foot elastic "decoupler" or vibration isolator sections to reduce towing noise, twenty-four 100 meter active sections and one 200 foot elastic section on the outboard end of the array. Each of the twenty-four 100 meter active sections contains four individual active elements with eight hydrophones equally spaced over a length of 12.5 meters. Between each 12.5 meter active element is 12.5 meters of inactive cable resulting in a spacing of 25 meters between elements. Six strategically located depth transducers provided a monitor of cable depth, and the array depth was held at approximately 450 - 500 feet for both tow and parachute mode data gathering. A strain gauge load-cell monitored the streamer tension from both the instrument room and wheel house. Tow and parachute mode configurations are illustrated in Figures 5 and 6.

(u) The frequency response and sensitivity of a typical section are shown in Figure 7.

(u) For SQUARE DEAL the desired array operating depth in both tow and parachute mode was 400 - 500 feet. This depth is well beyond the normal operating range encountered in ordinary geophysical exploration. In order to meet this depth requirement both the Multidyne™ hydrophones and the depth transducers were modified for the streamer used on this project.

(u) Details on the multi-element configuration used in the field include:

a.) 96 active groups or elements
b.) 25 meter group center to center spacing
c.) Eight (8) hydrophones in each active group, linear spacing
d.) 2387.5 meter active length, end to end
e.) Six depth transducers located at the forward end of group No. 96 (inboard end of streamer), 80, 60, 40, 20, and 4 (outboard end)

(u) During the tow mode of operation nine array depth controllers were used. These units were located as follows beginning at the inboard end of the streamer and proceeding to the outboard end:

Aft end of second elastic section
Inactive cable section aft of group No. 85, 77, 65, 53, 41, 29, and 13
Forward end of tail elastic section

(u) A specially fabricated streamer input junction panel was installed in the instrument room in order that any 48 of the total 96 active elements could be recorded on the DFS III digital recording system.

RECORDING INSTRUMENTS

(u) 1. Digital Recorder

(u) All streamer data were recorded with a Texas Instruments Model DFS III digital recording system with binary-gain ranging (BGA) amplifiers. The system instrumentation block is illustrated in Figure 8. These instruments are custom installed in shock-mounted computer cabinets in the instrument room along with the camera controller, monitors and other peripheral equipment.

(u) The following features describe main functions of the system:

1. 48 recording channels
2. Dual ten-inch reel tape decks
3. Read-after-write which allows data to be monitored in real time
4. A 9-track, 1/2 inch tape recorded in SEG-EPR Format "A". See attached 2 byte format, Figure 9
5. Custom equipment controller which controls both monitor camera and start up of DFS III if desired. Manual mode was used almost entirely for 12 minute recording duration.

(u) The following data monitors are also included:

1. 32-trace SIE Model ER-6 electrostatic camera which provides wiggle-trace records at selected intervals, (of the 48 seismic traces that were recorded on tape odd traces were photographed alternately with even traces)
2. Six cable depth readouts

(u) The seismic amplifier passband was 8-62 HZ , with a slope of 18 dB/octave on the low frequency cutoff and 72 dB/octave on the high frequency cutoff. Instrument amplitude and phase response plots are shown in Figures 10 and 11. The response is from amplifier input terminals to recording tape. The curves were obtained by applying a single input pulse, and calculating the curves on a computer using the output data read from the tape recording. The gain ranging amplifiers were operated in "fixed gain" mode only, with total gain of 90 to 108 dB.

(u) Figure 12 is a block diagram showing signal flow for the nine track DFS III digital recording system. This system is perhaps similar to other digital recorders, with the exception of the binary gain ranging amplifier which was pioneered by the geophysical industry.

(u) Figure 13 is a simplified block diagram showing signal flow for a single channel. Seismic data enters from the seis lines on connector J101 at the left. The input waveform is assumed to be a sine wave as shown in the upper left of the figure.

(u) The connection from J101 goes to CHANNEL switch S102 and on to switch S101. In the OPERATE position the signals from the seis line connect straight through to the record/reproduce relay.

(u) The first circuit on the filter card is the preamplifier. This is a low noise amplifier to provide gain prior to the filter circuits. The preamplifier output goes to the low-cut filter. The low-cut filter may be set to cut off at 8, 12, 18 or 27 HZ. The filter may be out, or have a slope of 18 decibels per octave or 36 decibels per octave. For SQUARE DEAL, the low-cut filter was always set to 8 HZ and a slope of 18 dB/ octave.

(u) The low-cut filter output goes to the notch filter connector. If notch filters are not installed in the system, a notch filter bypass card is installed which completes the circuit. The SECo system does not have notch filters. The notch filter output goes to the high-cut filter. The high-cut filter offers cutoffs of 31, 62, 124, or 248 HZ. The slope is 72 decibels per octave. The steep slope permits this filter to function as the anti-aliasing filter. SQUARE DEAL data was obtained at a 4 milliscond sampling rate, with corresponding high-cut filter setting of 62 HZ.

(u) The high-cut filter output goes to the chopper card. There is one chopper per amplifier channel. This chopper is a full wave chopper running at 1000 HZ. The signal out of the chopper is a suppressed carrier, double sideband, modulated waveform as shown at the upper right of Figure 13. The signal from the chopper goes to the binary gain amplifier. This amplifier provides the bulk of gain and also the variable portion of the gain. The gain is in 2-to-1 steps; hence the name binary gain amplifier.

(u) The binary gain amplifier output is the amplifier module output. This goes to the analog to digital Converter/Multiplexer Module.

(u) Since the output is a modulated waveform, it cannot directly drive a galvanometer.

(u) For this reason a small part of the Converter/Multiplexer Module appears on the lower half of Figure 13. The dash line from output connector J103 is shown going to the Converter/Multiplexer Module output amplifier.

(u) This is just a unity gain buffer amplifier to provide a low impedance to the multiplexer switch. The multiplexer switch connects to the ADA comparator card.

(u) The chopper drive is synchronized with the multiplexer switch. When the chopper closes in the noninverting mode, 468-3/4 micro-seconds later the multiplexer switch closes. The sample is taken on the last 31-1/4 micro-seconds of the chopper waveform. This permits almost 500 microseconds of time for the amplifier to settle after the chopper has switched. The sample taken by the multiplexer switch and fed to the ADA comparator is exactly the same as a sample obtained if the chopper is not used; therefore, the multiplexer switch performs a demodulating function for the analog-to-digital converter.

(u) The multiplexer switch output goes to a digital-to-analog drive amplifier. This goes to a demultiplexer switch which connects to a hold amplifier. The hold amplifier stores the sample on a capacitor. The amplifier input impedance is sufficiently high for the capacitor to hold this sample until the next time the switch closes. The hold amplifier output goes to the playback filter. The function of the playback filter is to remove the ripple at the sampling frequency. The playback filter output is a reconstructed analog signal. This is the circuit used in recording and in making a direct playback for driving the galvanometer.

(u) In order to provide an analog signal of an acceptable level for the NUC furnished equipment, a multi-output junction panel was built and installed in the instrument room. The signal for each of the 48 channels of the DFS III was taken from the analog playback portion of the converter-multiplexer module. A schematic of the analog playback section indicating the point at which these signals were obtained is shown in Figure 14.

(u) Examples of monitor records are described and illustrated in the section on field data.

(u) 2. Analog Recorder

Analog recording equipment for this exercise was supplied by NUC. These recorders and other NUC furnished equipment are shown in the Data Acquisition Equipment Block Diagram, Figure 8.

(u) 3. SECo Beam Former

The Seismic Engineering Company Beam Former design uses straightforward analog circuitry in a sophisticated manner to combine signals from 32

(u) hydrophone groups to make them into a highly directional beam. In the present model, up to 19 separate directional beams can be monitored simultaneously, extending from straight ahead, through broadside, to straight behind. Preset shading of input signal levels minimizes spurious response from unwanted sidelobes, and unique circuitry allows linear response from low frequencies on up to 30 HZ. Special beam angles, frequency response, and numbers of input signals and beams could be provided on special order, but extended capabilities would require a larger cabinet and additional electrical power. General beam former characteristics are shown in Table III. Characteristics of the beams formed by the present model are listed in Table IV. The beam former as used in SQUARE DEAL is shown in Figures 15 through 17.

(u) The entire beam former is contained in a single cabinet which contains two drawers. The lower drawer contains isolation transformers and power supplies. The upper drawer contains the beam forming circuitry on printed-circuit cards. Although their gain and phase-shift adjustments vary, there are only three basic circuit-card types used in the beam former, and they use many similar components so that spares provisioning for this reliable machine is quite simple.

(u) Signal from each hydrophone group is routed through a buffer amplifier before application to beam forming circuits. Each input amplifier circuit card contains four amplifiers and their shading adjustments, so only eight input cards are required. Each input amplifier card drives a row of beam forming cards. Beams looking aft of broadside are formed on one side of the drawer. Beams looking forward of broadside are formed on the other side of the drawer. Cards at the center form beams near broadside; larger angles from broadside are formed by cards further from the center. Beam forming card outputs are routed through an output amplifier which includes a dc offset adjustment. All circuit cards carry a regulator circuit which stabilizes its power supply voltages.

(u) The beam forming circuit cards each carry eight modules which provide a preset time delay. That time delay is independent of signal frequency throughout the specified passband. Input signals are delayed and combinded progressively so that, as a sound wave passes the array the outputs it causes are added in the proper phase to reinforce each other. Fine adjustment of the delay in each module is provided for refining the beam pattern. Output from the fourth beam forming card is the sequential delayed sum of each shaded hydrophone signals.

TABLE III

BEAM FORMER CHARACTERISTICS

Characteristic	Value
Type	Analog, active delay
Input	Presently 32 with amplitude shading Expandable to 64
Distortion	Less than 0.5%
Dynamic Range	60 dB
Outputs	15 simultaneous beams, any angles from forward (end fire) through broadside to behind (end fire). Expandable to any number of beams
Assumptions	
Sound Velocity (v)	4068 feet per second
Array Spacing (d)	25 meters (82.025 feet)
Angle Delay (d/v sinA)	6.849 ms.
Delay Modules	
Delay accuracy	$\pm$ 0.25° phase shift
Gain	1.00, $\pm$ 0.1 dB
Power Required	115 volts, 60 HZ, 1000 watts
Dimensions	18-1/2 in high x 19-3/4 wide x 26 in deep

TABLE IV

PRESENT CONFIGURATION

Characteristic		Value	
Output beam angles and delays (symetrical from broadside)		0^{o}	0.00 ms
		6.37^{o}	1.87 ms
		12.83^{o}	3.74 ms
		19.47^{o}	5.61 ms
		26.38^{o}	7.48 ms
		33.74^{o}	9.36 ms
		41.81^{o}	11.23 ms
		51.05^{o}	13.10 ms
		62.73^{o}	14.97 ms
		90.00^{o}	16.84 ms
Shading Values			
Array group no.	1	0.44	
	2	0.24	
	3	0.30	
	4	0.37	
	5	0.44	
	6	0.51	
	7	0.58	
	8	0.65	
	9	0.72	
	10	0.78	
	11	0.84	
	12	0.89	
	13	0.93	
	14	0.97	
	15	0.99	
	16	1.00	
	17	1.00	
	18	0.99	
	19	0.97	
	20	0.93	
	21	0.89	
	22	0.84	
	23	0.78	
	24	0.72	
	25	0.65	
	26	0.58	
	27	0.51	
	28	0.44	
	29	0.37	
	30	0.30	
	31	0.24	
	32	0.44	

(u) 4. Navigation System

(u) The SEISMIC EXPLORER has on board a satellite Navigation System consisting of a Magnavox Model MX-702 satellite receiver, a Hewlett Packard Model HP2100 digital computer with 16 K memory, a high speed punch tape reader for loading the computer program, and a teleprinter for entering variable parameters and printing satellite fix positions. These are shown in block form in Figure 18.

(u) The navigation satellites are in circular polar orbits, about 600 nautical miles high. Each point on the revolving earth passes under every satellite orbit twice in 24 hours. Because the satellites circle the earth in only 1-3/4 hours, they pass within the line of sight of an earth observer at least twice each time he is near an orbit. Therefore, each satellite will provide at least four navigation fixes per 24 hour day. With the five satellites being maintained operational today, one can expect no less than 20 passes per day averaging 1.2 hours between fixes.

(u) There are three factors which influence satellite position fix accuracy. They are: 1) accuracy of expressing the ship's motion 2) accuracy of the antenna height, which is derived by reference to a geoidal height map 3) adequacy of the satellite navigation equipment and fix program. The overall accuracy of the total system varies between 200 and 600 feet based on measurements in the field.

(u) The computer program used on the SEISMIC EXPLORER contained a dead reckoning feature (DR) which provided a position print-out at any time. The DR was up-dated at each satellite fix provided certain standards were met. The accuracy of the DR was dependent upon the vessel speed and heading which were entered manually.

FIELD DATA

(c) 1. Operation

(u) The field program began with the mobilization of the M/V SEISMIC EXPLORER in the Dutch port of Den Helder on 8-3-73.

(u) Mobilization was completed and the vessel cleared at 1600 on 8-22-73, underway for the exercise area. While some preliminary work had been done toward balancing the seismic array, it was decided that additional checks of towing characteristics should be made in deep water approximating the temperature and salinity conditions expected in the project area.

(c) On 8-25-73 with the vessel well off the west coast of the Republic of Ireland, the array was deployed. It was found that additional weights were required at various locations along the length of the cable. Also, there was some difficulty encountered in maintaining the desired towing depth of 450 - 500 feet at a vessel speed of 3.5 - 4.0 knots. This was overcome by attaching a 500 lb. depressor to the aft portion of the faired lead-in.

(c) The following day, 8-26-73, the vessel proceeded to the immediate vicinity of Station 2BC. The array was again deployed and additional refinements made in balancing together with a thorough check of all electronic equipment. At 1400 another vessel was sighted in the area. This was identified visually as the USNS KINGSPORT, although no radio contact was made or attempted at this time.

(c) At 0550 on 8-27-73, radio contact was established with the KINGSPORT in order that the array calibration procedures with the RMAS BULLFINCH could be coordinated. It was decided that the SEISMIC EXPLORER would tow on a heading of 090° while the BULLFINCH towed at 270°. The KINGSPORT also indicated that due to wind and sea conditions she must maintain some headway for control and would do so on a heading of approximately 270°. The sound source would be turned on at 0900.

(c) The SEISMIC EXPLORER then proceeded to a point approximately 12 n.m. west of the KINGSPORT where the array was deployed. The vessel then began towing toward the KINGSPORT. The EXPLORER'S heading, as well as the relative bearing and radar range of the KINGSPORT were recorded at 5 minute intervals beginning at 0805 and ending at 1210, at which time, the calibration run was completed. This information is shown in Table V. Figure 19 is a plot of the approximate courses of both the SEISMIC EXPLORER and the KINGSPORT during the calibration run. This plot is based on satellite position locations obtained by the EXPLORER and the range and bearing of the KINGSPORT at selected times.

(c) Four twelve minute recordings were made during this operation and the locations are also shown on Figure 19. Figure 20 is a portion of the field monitor of tape record No. 3. Noise patterns associated with the other vessels in the area are readily apparent.

(c) After retrieving the array, the vessel proceeded to the area of Station 2B. At this location, a series of directional noise measurements using a collapsed polygon technique were to be made in coordination with the BULLFINCH. At this site, three equilateral triangles were run with the vessels displaced seven nautical miles from the site along a line running 080° - 260°. The SEISMIC EXPLORER occupied the southwest location.

(c) The array was deployed and at 1900 on 8-27-73 the first leg of the collapsed polygon was begun. The headings for each side of the polygon were specified in the exercise plan, but wind, sea, and current conditions resulted in the actual headings being somewhat different. Table VI indicates the proposed and actual headings for each side at this and all other sites involved in this portion of the exercise.

(c) Each leg of the event was run for one hour at a speed of 3.5 - 4.0 knots, with the array at approximately 400 - 450 feet. Figure 21 indicates the actual geometry of the polygon, as well as the location of each recording.

(c) One twelve minute recording was made on each side of the polygon. These are identified as reels No. 5 through 13. All recordings were taken during the last fifteen minutes that each leg was occupied, to allow ample time for the array to become straight and as quiet as possible after the previous course change.

(c) During the recording of reel No. 6 on leg 2, several random bursts of coherent energy were noted. An example of this is shown by Figure 22 taken from the field monitor of this recording.

(c) Several other recordings at this site (notably reel No. 5 from leg No. 1, and reel No. 13 from leg No. 9) exhibited noise patterns characteristic of another vessel in the general area. This is indicated as a series of low amplitude pulses of approximately 40-45 HZ. This is shown by Figure 23 taken from the monitor record of recording No. 5. It is felt that this signal is most likely due to the BULLFINCH, which was in position almost dead astern of the SEISMIC EXPLORER at the time of this recording.

(c) At 0400, on 8-28-73, the polygon at site 2B was completed. The array was retrieved and the vessel departed for the next station.

(c) At 1000, on 8-28-73, the vessel arrived at site 2D. Operations, at this location, were exactly the same as at the previous site, except that

(c) the vessels were displaced along a line running 060° - 240°. At 1400 leg 1 of the polygon was begun. The actual geometry of the event is shown in Figure 24. Somewhat better control was maintained at this site with more favorable wind and sea conditions.

(c) Again one twelve minute recording was made during the last 15 minutes of each leg, and these are identified as reels No. 14 through 22.

(c) At 1620, while running on leg 3 of the polygon, a large container type cargo vessel was sighted at a range of approximately seven miles and 030° off the port bow. During the recording of reel No. 16 on this leg the cargo vessel's position was 055° T at a range of 8.5 n.m. at the beginning of recording and 070° T at a range of 12.4 n.m. at the end. Noise from this vessel is apparent on the recording made on leg 2 (reel No. 15) also. Figure No. 25 is from the field monitor of recording No. 16. Some low amplitude vessel noise is indicated on recording No. 21, taken on leg No. 8 of this polygon. The source appears to be at approximately 090° relative to the array and again it is felt this is probably the BULLFINCH.

(c) At 2300, on 8-28-73, the polygon at site 2D was completed. The array was retrieved and the vessel departed for the next area.

(c) At 0615, on 8-29-73, the vessel arrived at location 2A in relatively high winds and sea state 7. The array was deployed and leg 1 was begun at 1000. Operations were the same as for the previous station, except only the first six legs of the collapsed polygon were to be run. Recording times and procedures were maintained as before, with the six recordings identified as reels No. 23 through 28. Figure 26 is a plot of this polygon as run.

(c) At 1600, the operation at this location was complete, and the array retrieved. The vessel then departed for the next site.

(c) On 8-30-73, at 0400, the vessel arrived in the area of site 2F. The procedure at this location was for the BULLFINCH and the SEISMIC EXPLORER to tow their arrays in such a manner that a twelve sided polygon was formed with the sides displaced 6.5 n.m. from the center. The EXPLORER was to start on a heading of 180° while the BULLFINCH began on the opposite side of the polygon at 000°. Each leg was to be occupied for one hour.

(c) When the vessel was in position to place the array in the water, the sea state was 7-8, with 35 - 40 knot winds. This resulted in some difficulty in deployment and maneuvering into position for the first leg of the event. Side one was begun at 0800, two hours after the time scheduled. This delay was, however, within the limits of the exercise plan and was approved by the SSOR, Mr. H. Aurand.

(c) All sides of the polygon were occupied for one hour and a recording made during the last 15 minutes of each. These are identified as reels No. 29 through 40. Figure 27 is a plot of the polygon as run.

(c) Leg number twelve was completed at 2000 and the array picked up. This completed all scheduled tow mode operations for the exercise.

(c) During the remainder of the night the vessel proceeded at greatly reduced speed toward the general area of site 3QB where the array was to be deployed in a stationary or parachute mode. Both wind and sea conditions steadily worsened, and late on 8-31-73 the SSOB decided that no attempt should be made to conduct the planned exercise at station 3QB, but the vessel should proceed to site 3QD for the second phase of the parachute mode operation. The vessel continued running slowly southwest through 9-1-73 with approximately 40 knot winds and a sea state of 8-9.

(c) Early on 9-2-73, sea conditions improved somewhat and speed was increased running on a course for site 3QD. At 1430, the vessel arrived on location and rigging began for the parachute mode operation. The 100 foot parachute supplied by NUC was attached to the outboard end of the array with appropriate weights and 500 feet of line to a surface buoy, which was equipped with a high intensity flasher and a radar reflector. In this mode the array was deployed, and at 1920 the main engines were shut down and the vessel became dead in the water with one of the ship's generators supplying power.

(c) Figure 28 illustrates the overall detection experiment. This includes the SEISMIC EXPLORER parachute mode sites as well as the array tow track of the BULLFINCH, and the sound source tow track of the KINGSPORT. The SEISMIC EXPLORER recording operation at site 3QD began with the KINGSPORT at approximately site 3QC.

(c) At 2200 the detection experiment was begun with the KINGSPORT transmitting a signal during the first and third fifteen minute period of each hour. One twelve minute recording was made each two hours, on the odd numbered hour. The initial six minutes of each was made with the signal off and the last six minutes with the signal on. A total of 19 recordings were made with the first at 0057 on 9-3-73. They are identified as reels No. 41 through 59. Figure 29 is a plot of the vessel during this operation. Drift was generally toward the east at a rate of approximately 0.5-0.6 n.m. per hour.

(c) The KINGSPORT and the BULLFINCH were sighted at 1100 on 9-3-73 with the KINGSPORT approaching from the east and the BULLFINCH from the northeast. Drift at this time had been approximately 12 n.m. east from site 3QD. At 1410 the KINGSPORT was observed making a turn to the southeast for the next leg of her run.

(c) By 1600 it was no longer possible to identify the array tail buoy, and all depth indicators read in excess of 500 feet. It was, however, decided to remain in position.

(c) At 0030 on 9-4-73, the outboard groups of the array appeared to have a much reduced energy output. The explosive cable cutter was fired to release the parachute and the array retrieved. It was found that at least the last 31 groups of the array had been damaged beyond use, due to excessive depth. The supporting buoy had become damaged or lost resulting in the slow sinking of the cable. Several sections of the array were replaced in order that the operation could continue even though the full 96 trace capability could not be utilized. Due to the damage of some depth transducers, the remainder of the operation was carried out with only two in working order. After returning to a point approximately 10 miles east of site 3QD, the array, parachute, and buoy were redeployed and at 1015 the cable was in the water and the experiment continued.

(c) Figure 30 is taken from the field monitor of recording No. 41, and shows a strong noise front characteristic of a small explosive charge. From a time and spatial analysis, the source energy is coming from approximately 193° T or 283° T.

(c) Figure 31 is from the field monitor of recording No. 44, and indicates a noise front arriving from slightly aft of broadside relative to the array. Figure 32 is from the same field monitor and shows a similar noise pattern arriving 2.2 seconds later. Following this second arrival, the monitor was run for an additional 4.2 seconds with no further energy fronts. Similar events were noted on recordings No. 45, 46, and 47.

(c) Figure 33 shows a noise pattern from the field monitor of recording No. 55. This has the appearance of vessel noise with a frequency of approxmately 50 HZ. Analysis indicates the energy source to be at 038° T or 152° T. No vessels were visible on maximum radar range of 48 n.m. at this time.

(c) On recording No. 57, a relatively strong noise front, similar to that shown in Figure 31 from recording No. 44, was noted. Approximately 15 seconds later a like event was recorded and 2 seconds after this noise front a third event was seen. Throughout the entire length of this field monitor a very weak pattern of vessel noise is apparent. Figure 34 is from this monitor and shows both noise patterns.

(c) The field monitor of recording No. 59 shows one extremely strong noise front. Figure 35 is taken from this monitor. Analysis indicates the energy source to be at 222° T or 358° T.

(c) The parachute mode of operation at site 3QD was completed at 2400 on 9-4-73. The parachute was released and the array recovered. After recovering the buoy and chute the vessel departed the area and the exercise was complete.

(u) A complete daily operations log is included in this report as Table VII.

(c) To further aid in identifying events, vessels, etc., a chronological contact log for both visual and radar contacts is included as Table VIII.

(u) 2. Navigation Data

(u) Figures 19,21,24,26,27, and 29 show tow and parachute mode ship track plots mapped from satellite data. Recording locations and satellite position fixes are shown. On those figures relating to tow mode polygon operations, a tabulation is shown indicating the bearing, time occupied and recording number for each leg of the polygon.

(c) For the three collapsed polygon maneuvers (site 2B, 2D, and 2A) the track plots indicate the difficulty experienced in attempting to maintain the desired ships heading and speed. No corrections were made during the running of a leg, since this would have caused undesirable bursts of noise on the array. Considerably better control was maintained on the twelve sided polygon. In this case, the smaller course changes allowed the helmsman to better judge the effects of sea conditions and make the necessary corrections at each course change.

(u) Table VI lists all polygon locations with the proposed heading, as specified in the exercise plan, and the actual heading as each side was run. Included in this table are the dates and times each leg was occupied as well as the recording number.

(u) 3. Data Recording

(u) The numerous logs, reports, etc. compiled during the field exercise have been condensed into Table IX, where each reel is identified with as many of the recording parameters as possible.

(u) Examination of monitor oscillograph records indicate data quality to be excellent. Field monitors were usually limited to 6-12 seconds in length; however, continuous oscilloscope monitoring was made during the entire twelve minute recording cycle.

(u) The array used in this exercise consisted of 96 groups with a selection of any 48 groups in the cable to be recorded. Those groups selected for recording varied from location to location. Table X lists the group numbers used at each location and the tape channel assignment for each group. In all cases the group nearest the vessel was recorded on tape channel 1 and the far group on tape channel 48.

(c) As discussed earlier, numerous recordings indicated noise bursts of various patterns. Since the general source orientation is toward deep water areas, this would seem to eliminate normal geophysical exploration activity as the source. Timing indicates that at least some of the recorded noise bursts are the result of ship and/or aircraft drop charges, which were a part of this overall exercise. Additional analysis would be necessary to determine if the above relation is valid. In any case, monitor records are not indicative of what may be searched out with beam forming and computer processing of these data.

(c) Also mentioned earlier are several recordings with energy patterns generally associated with vessel noise. A number of these are obviously the result of commercial shipping or operations involving the BULLFINCH and/or KINGSPORT. Others, such as discussed in connection with recording No. 57, are not related to any known vessel. There were, of course, numerous vessels taking part in this exercise, which had no direct relation to the SEISMIC EXPLORER. Again, additional analysis with the overall exercise plan available would be necessary to resolve these data.

TABLE II

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
239 27 Aug 73	0544	054°23.251'N 013°03.857'W	Fair	Holding in area of 2BC
239	0546	054°27.782'N 012°58.677'W	Very Poor	Same
239	0604	054°29.537'N 012°59.051'W	Good	Site 2BC
239	0632	054°29.064'N 013°07.439'W	Good	Underway for array lay-out point for calibration run
239	0734	054°29.862'N 013°22.048'W	Good	During array deployment
239	0754	054°30.473'N 013°21.703'W	Fair	Same
239	0920	054°31.340'N 013°13.287'W	Good	On calibration run-site 2B.
239	1106	054°31.112'N 013°03.339'W	Good	Same
239	1154	054°31.140'N 013°00.735'W	Good	Same
239	1322	054°29.844'N 012°49.529'W	Poor	During array pick-up
239	1358	054°30.983'N 012°52.549'W	Fair	Transit site 2BC to site 2B
239	1546	054°10.136'N 013°11.104'W	Good	Same
239	1628	054°06.546'N 013°14.211'W	Fair	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
239	1656	054°07.904'N 013°11.106'W	Good	Holding in area 2B
239	1732	054°11.160'N 013°09.130'W	Good	During array deployment
239	1800	054°09.471'N 013°10.686'W	Very Poor	Same
239	1816	054°10.001'N 013°12.277'W	Poor	Same
239	1942	054°07.614'N 013°20.688'W	Good	On side 1 of polygon site 2B
239	2000	054°06.850'N 013°22.312'W	Good	Start side 2
239	2130	054°06.485'N 013°17.339'W	Good	On side 3
239	2318	054°07.342'N 013°20.847'W	Fair	On side 5
239	2344	054°05.869'N 013°18.719'W	Fair	Same
240	0128	054°08.212'N 013°14.832'W	Fair	On side 7
240	0208	054°08.860'N 013°17.040'W	Fair	On side 8
240	0312	054°04.870'N 013°14.187'W	Good	On side 9
240	0352	054°06.402'N 013°10.324'W	Good	Same
240	0502	054°07.329'N 013°07.253'W	Fair	Transit site 2B to site 2D

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
240	0538	054°14.999'N 013°10.181'W	Good	Same
240	0644	054°28.394'N 013°15.739'W	Good	Same
240	0702	054°31.813'N 013°17.788'W	Good	Same
240	0730	054°37.840'N 013°20.168'W	Very Poor	Same
240	0832	054°49.898'N 013°25.341'W	Good	Same
240	0852	054°53.827'N 013°27.124'W	Fair	Same
240	1018	055°05.996'N 013°36.876'W	Good	Holding in area of site 2D
240	1044	055°05.355'N 013°39.579'W	Fair	Same
240	1204	055°05.529'N 013°41.615'W	Poor	During array deployment
240	1228	055°06.026'N 013°40.628'W	Good	Same
240	1416	055°10.898'N 013°45.016'W	Good	On side 1 of polygon site 2D
240	1454	055°09.961'N 013°49.968'W	Good	Same
240	1600	055°08.154'N 013°45.041'W	Good	Start side 3
240	1640	055°11.129'N 013°43.247'W	Good	On side 3

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Positions Fix	Fix Quality	Activity
240	1724	055°12.520'N 013°45.432'W	Good	On side 4
240	1746	055°12.547'N 013°47.877'W	Very Poor	Same
240	1826	055°11.335'N 013°48.592'W	Fair	On side 5
240	1854	055°09.154'N 013°46.729'W	Good	Same
240	2038	055°14.476'N 013°45.946'W	Fair	On side 7
240	2100	055°15.478'N 013°50.372'W	Fair	Start side 8
240	2226	055°11.800'N 013°44.940'W	Good	On side 9
241	0018	055°16.151'N 013°42.058'W	Very Poor	Transit site 2D to site 2A
241	0038	055°19.212'N 013°44.448'W	Fair	Same
214	0120	055°25.876'N 013°49.092'W	Very Poor	Same
241	0218	055°35.936'N 013°55.627'W	Good	Same
241	0302	055°43.406'N 013°58.439'W	Good	Same
241	0406	055°54.179'N 014°02.732'W	Good	Same
241	0426	055°57.458'N 014°04.143'W	Good	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
241	0448	056°00.921'N 014°05.529'W	Fair	Same
241	0554	056°11.269'N 014°10.617'W	Poor	Same
241	0616	056°14.014'N 014°16.518'W	Fair	Holding in area of site 2A
241	0636	056°14.867'N 014°09.998'W	Fair	Same
241	0740	056°14.647'N 014°04.579'W	Good	Same
241	0802	056°13.552'N 014°05.921'W	Good	Same
241	0928	056°08.822'N 014°07.296'W	Good	During array deployment
241	1114	056°04.633'N 014°14.126'W	Good	On side 2
241	1150	056°03.337'N 014°10.032'W	Poor	Same
241	1318	056°07.700'N 014°08.210'W	Good	On side 4
241	1402	056°08.023'N 014°13.419'W	Good	On side 5
241	1512	056°04.813'N 014°06.076'W	Poor	On side 6
241	1548	056°06.707'N 014°03.839'W	Good	Same
241	2352	057°00.516'N 012°04.287'W	Good	Transit site 2A to site 2F

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
242	0124	057°12.390'N 011°36.999'W	Good	Same
242	0144	057°14.956'N 011°30.839'W	Fair	Same
242	0212	057°18.147'N 011°24.162'W	Good	Same
242	0310	057°26.570'N 011°09.416'W	Good	Same
242	0332	057°29.739'N 011°03.778'W	Fair	Same
242	0356	057°32.947'N 010°56.326'W	Poor	Same
242	0500	057°33.398'N 011°00.023'W	Fair	During array deployment
242	0522	057°34.304'N 010°58.736'W	Good	Same
242	0546	057°34.028'N 010°56.576'W	Good	Same
242	0652	057°31.329'N 010°51.070'W	Good	Array out in heavy seas maneuvering in area
242	0712	057°30.234'N 010°51.773'W	Good	Same
242	0900	057°23.670'N 010°55.458'W	Fair	Start side 2 of polygon at site 2F
242	1054	057°19.080'N 011°02.106'W	Fair	On side 3
242	1222	057°19.447'N 011°12.193'W	Good	On side 5

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
242	1244	057°20.148'N 011°14.583'W	Fair	Same
242	1310	057°21.123'N 011°17.204'W	Fair	On side 6
242	1408	057°23.887'N 011°21.009'W	Good	On side 7
242	1432	057°25.257'N 011°20.967'W	Fair	Same
242	1456	057°26.721'N 011°21.693'W	Good	Same
242	1550	057°30.303'N 011°17.801'W	Good	On side 8
242	1614	057°31.414'N 011°15.667'W	Poor	On side 9
242	1642	057°32.244'N 011°11.805'W	Good	Same
242	1720	057°32.738'N 011°07.302'W	Poor	On side 10
242	1738	057°33.029'N 011°05.072'W	Fair	Same
242	1830	057°32.134'N 010°58.795'W	Fair	On side 11
242	1904	057°30.825'N 010°55.038'W	Good	On side 12
242	1922	057°29.852'N 010°53.735'W	Good	Same

No position data are available for a portion of the transit site 2F to 3QD

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
245	0612	055°29.965'N 014°00.186'W	Fair	Transit site 2F to site 3QD
245	0632	055°28.571'N 014°01.390'W	Fair	Same
245	0758	055°22.077'N 014°12.002'W	Good	Same
245	0820	055°19.114'N 014°15.081'W	Good	Same
245	0946	055°07.430'N 014°28.017'W	Good	Same
245	1016	055°03.376'N 014°32.202'W	Poor	Same
245	1124	054°52.841'N 014°38.925'W	Very Poor	Same
245	1312	054°35.189'N 014°48.911'W	Good	Same
245	1348	054°29.108'N 014°50.472'W	Good	Same
245	1410	054°25.403'N 014°53.605'W	Good	Same
245	1458	054°19.671'N 014°59.154'W	Good	Same
245	1536	054°17.489'N 015°03.918'W	Fair	Holding in area of site 3QD
245	1556	054°16.022'N 015°05.223'W	Poor	Same
245	1644	054°18.132'N 015°01.588'W	Good	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
245	1744	054°19.972'N 014°58.840'W	Good	Same
245	1822	054°21.569'N 015°02.781'W	Good	During array deployment
245	1844	054°21.739'N 015°01.675'W	Fair	Same
245	1930	054°22.716'N 015°00.817'W	DR	On parachute-vessel dead in water
245	2006	054°23.190'N 014°59.631'W	Good	On parachute
245	2030	054°23.194'N 014°59.151'W	Good	Same
245	2154	054°23.400'N 014°56.442'W	Very Poor	Same
245	2228	054°23.604'N 014°56.608'W	Poor	Same
245	2334	054°23.731'N 014°55.166'W	Very Poor	Same
246	0010	054°23.707'N 014°54.632'W	Good	Same
246	0116	054°23.701'N 014°53.164'W	Good	Same
246	0156	054°23.556'N 014°52.464'W	Good	Same
246	0218	054°23.637'N 014°51.835'W	Good	Same
246	0304	054°23.472'N 014°51.214'W	Good	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
246	0348	054°23.399'N 014°50.140'W	Poor	Same
246	0406	054°23.421'N 014°49.549'W	Very Poor	Same
246	0452	054°23.224'N 014°49.056'W	Fair	Same
246	0524	054°23.272'N 014°48.290'W	Very Poor	Same
246	0544	054°23.402'N 014°47.904'W	Good	Same
246	0710	054°23.712'N 014°46.182'W	Good	Same
246	0730	054°23.954'N 014°46.131'W	Good	Same
246	0858	054°24.129'N 014°44.400'W	Good	Same
246	0918	054°24.376'N 014°44.418'W	Fair	Same
246	1044	054°24.429'N 014°42.594'W	Good	Same
246	1112	054°24.340'N 014°41.924'W	Good	Same
246	1216	054°24.339'N 014°40.815'W	Good	Same
246	1300	054°24.337'N 014°40.359'W	Poor	Same
246	1402	054°24.167'N 014°38.689'W	Good	Same
246	1446	054°24.138'N 014°37.814'W	Good	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
246	1510	054°23.996'N 014°37.439'W	Poor	Same
246	1550	054°23.930'N 014°36.292'W	Good	Same
246	1608	054°23.930'N 014°36.413'W	Good	Same
246	1652	054°23.606'N 014°34.833'W	Good	Same
246	1738	054°23.736'N 014°33.793'W	Very Poor	Same
246	1754	054°23.501'N 014°33.405'W	Good	Same
246	1838	054°23.479'N 014°32.923'W	Poor	Same
246	1918	054°23.476'N 014°31.822'W	Good	Same
246	1940	054°23.375'N 014°31.455'W	Fair	Same
246	2104	054°23.496'N 014°30.048.W	Good	Same
246	2254	054°23.292'N 014°28.571'W	Good	Same
247	0024	054°23.061'N 014°27.154'W	Good	Same
247	0108	054°22.883'N 014°27.388'W	Poor	Same
247	0128	054°24.176'N 014°28.140'W	Poor	During array pick-up
247	0208	054°24.258'N 014°24.859'W	Poor	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
247	0256	054°24.402'N 014°20.470'W	Good	Same
247	0316	054°23.475'N 014°24.185'W	Fair	Holding in area for array repair
247	0354	054°23.523'N 014°25.250'W	Good	Same
247	0502	054°23.426'N 014°23.714'W	Poor	Same
247	0620	054°23.807'N 014°23.308'W	Good	Same
247	0644	054°23.929'N 014°23.260'W	Good	Same
247	0808	054°23.666'N 014°25.874'W	Good	Underway to array lay-out point
247	0830	054°23.133'N 014°32.554'W	Good	Same
247	0954	054°24.244'N 014°44.423'W	Good	During array deployment
247	1024	054°23.785'N 014°43.102'W	Poor	On parachute
247	1122	054°23.378'N 014°41.415'W	Very Poor	Same
247	1142	054°23.237'N 014°42.262'W	Very Poor	Same
247	1210	054°24.029'N 014°41.477'W	Good	Same
247	1308	054°23.810'N 014°40.539'W	Good	Same
247	1358	054°23.750'N 014°38.497'W	Good	Same

TABLE II Continued

(c) VESSEL POSITIONS

Date	Time GMT	Satellite Position Fix	Fix Quality	Activity
247	1418	054°23.621'N 014°38.580'W	Fair	Same
247	1454	054°23.090'N 014°36.333'W	Good	Same
247	1522	054°23.264'N 014°36.166'W	Poor	Same
247	1546	054°22.352'N 014°35.627'W	Poor	Same
247	1602	054°22.304'N 014°33.280'W	Fair	Same
247	1640	054°21.761'N 014°34.302'W	Fair	Same
247	1704	054°21.704'N 014°33.252'W	Good	Same
247	1746	054°20.974'N 014°32.571'W	Good	Same
247	1832	054°20.602'N 014°31.607'W	Good	Same
247	1850	054°20.372'N 014°32.072'W	Good	Same
247	2014	054°20.038'N 014°28.982'W	Poor	Same
247	2040	054°19.983'N 014°29.753'W	Fair	Same
247	2202	054°19.520'N 014°27.940'W	Good	Same
247	2236	054°19.559'N 014°26.854'W	Fair	Same
247 4 Sept. 73	2330	054°19.277'N 014°25.580'W	Poor	Same

Exercise Complete

TABLE V

(c) ARRAY CALIBRATION

DATE: August 27, 1973

Time GMT	EXPLORER Course Degrees True	KINGSPORT Bearing Degrees Relative	Range N.M.
0805	093	10° Port	8.50 n.m.
0810	091	5° Port	8.00 n.m.
0815	095	8° Port	7.75 n.m.
0820	094	10° Port	7.50 n.m.
0825	095	7° Port	7.00 n.m.
0830	094	12° Port	6.50 n.m.
0835	086	8° Port	6.00 n.m.
0840	087	7° Port	5.75 n.m.
0845	084	5° Port	5.50 n.m.
0850	085	8° Port	5.00 n.m.
0855	084	7° Port	4.75 n.m.
0900	088	10° Port	4.50 n.m.
0905	089	12° Port	4.10 n.m.
0910	087	14° Port	3.75 n.m.
0915	080	8° Port	3.50 n.m.
0920	082	13° Port	3.00 n.m.
0925	083	17° Port	2.80 n.m.
0930	083	20° Port	2.50 n.m.
0935	083	28° Port	2.25 n.m.
0940	086	35° Port	1.80 n.m.
0943	090	45° Port	1.75 n.m.
0945	091	48° Port	1.70 n.m.

TABLE V

(c) ARRAY CALIBRATION - Continued

DATE: August 27, 1973

Time GMT	EXPLORER Course Degrees True	KINGSPORT Bearing Degrees Relative	Range N.M.
0950	097	67° Port	1.60 n.m.
0955	102	90° Port	1.50 n.m.
1000	100	100° Port	1.55 n.m.
1005	098	110° Port	1.60 n.m.
1010	097	119° Port	1.80 n.m.
1015	098	125° Port	2.10 n.m.
1020	100	135° Port	2.40 n.m.
1025	100	142° Port	2.70 n.m.
1030	100	145° Port	2.90 n.m.
1035	101	150° Port	3.30 n.m.
1040	097	151° Port	3.60 n.m.
1045	097	151° Port	3.90 n.m.
1050	098	155° Port	4.20 n.m.
1055	102	160° Port	4.40 n.m.
1100	100	159° Port	4.90 n.m.
1105	100	160° Port	5.20 n.m.
1110	098	159° Port	5.50 n.m.
1115	097	160° Port	5.90 n.m.
1120	095	160° Port	6.10 n.m.
1125	096	161° Port	6.30 n.m.
1130	099	165° Port	6.90 n.m.
1135	096	162° Port	7.10 n.m.

TABLE V

(c) ARRAY CALIBRATION - Continued

DATE: August 27, 1973

Time GMT	EXPLORER Course Degrees True	KINGSPORT Bearing Degrees Relative	Range N.N.
1140	098	165° Port	7.30 n.m.
1145	096	165° Port	7.80 n.m.
1150	097	166° Port	8.10 n.m.
1155	099	167° Port	8.40 n.m.
1200	096	169° Port	8.70 n.m.
1205	102	170° Port	9.00 n.m.
1210	095	167° Port	9.30 n.m.

TABLE VI

(c) BEARING VARIATIONS, TIMES & REEL NOS.

Station	Leg No.	Bearings Proposed	Bearings Actual	Time Occupied	Reel No.	Date
2B	1	240.0	235.5	1900-2000	5	27 Aug. 73
2B	2	120.0	129.0	2000-2100	6	27 Aug. 73
2B	3	000.0	007.0	2100-2200	7	27 Aug. 73
2B	4	270.0	272.0	2200-2300	8	27 Aug. 73
2B	5	150.0	139.5	2300-2400	9	27 Aug. 73
2B	6	030.0	049.0	0000-0100	10	28 Aug. 73
2B	7	300.0	313.0	0100-0200	11	28 Aug. 73
2B	8	180.0	168.0	0200-0300	12	28 Aug. 73
2B	9	060.0	052.5	0300-0400	13	28 Aug. 73
2D	1	240.0	254.5	1400-1500	14	28 Aug. 73
2D	2	120.0	117.5	1500-1600	15	28 Aug. 73
2D	3	000.0	019.5	1600-1700	16	28 Aug. 73
2D	4	270.0	269.5	1700-1803	17	28 Aug. 73
2D	5	150.0	154.0	1803-1900	18	28 Aug. 73
2D	6	030.0	031.0	1900-2000	19	28 Aug. 73
2D	7	300.0	290.5	2000-2100	20	28 Aug. 73
2D	8	180.0	180.0	2100-2200	21	28 Aug. 73
2D	9	060.0	060.0	2200-2300	22	28 Aug. 73
2A	1	240.0	234.0	1000-1100	23	29 Aug. 73
2A	2	120.0	118.5	1100-1200	24	29 Aug. 73
2A	3	000.0	019.0	1200-1307	25	29 Aug. 73

TABLE VI Continued

(c) BEARING VARIATIONS, TIMES & REEL NOS.

Station	Leg No.	Bearings Proposed	Bearings Actual	Time Occupied	Reel No.	Date
2A	4	270.0	276.0	1307-1400	26	29 Aug. 73
2A	5	150.0	138.0	1400-1500	27	29 Aug. 73
2A	6	030.0	033.5	1500-1600	28	29 Aug. 73
2F	1	180.0	192.0	0800-0900	29	30 Aug. 73
2F	2	210.0	206.0	0900-1000	30	30 Aug. 73
2F	3	240.0	239.0	1000-1100	31	30 Aug. 73
2F	4	270.0	270.0	1100-1200	32	30 Aug. 73
2F	5	300.0	299.5	1200-1300	33	30 Aug. 73
2F	6	330.0	318.0	1300-1400	34	30 Aug. 73
2F	7	000.0	357.0	1400-1500	35	30 Aug. 73
2F	8	030.0	030.0	1500-1600	36	30 Aug. 73
2F	9	060.0	067.0	1600-1700	37	30 Aug. 73
2F	10	090.0	087.0	1700-1800	38	30 Aug. 73
2F	11	120.0	118.5	1800-1900	39	30 Aug. 73
2F	12	150.0	147.5	1900-2000	40	30 Aug. 73

TABLE VII

(c) DAILY OPERATIONS LOG

DATE	GMT	COMMENTS
7 26-73	1000	R. W. Miller and F. D. Barnett arrived in Den Helder, Netherlands. Ordered streamer fluid and sheet lead (for streamer weight) through Service International.
7-27-73	0900	Check on air transportation to Swansea, Wales, for Monday meeting. None available. Will fly to London and take train to Swansea.
7-28-73	1300	Depart Amsterdam for London.
7-29-73	1200	Depart Paddington Station, London, for Swansea via rail.
	1600	Arrive Swansea. Take taxi from station to dock area. Inquire of Harbor Master and lock operator as to location of the Kingsport. She is not in nor do they have any information on scheduled arrival.
	1700	Check in at Dragon Hotel and inquire for Burlie Brunsen with NUC. He is not registered there nor in any other first class hotel in Swansea.
7-30-73	0900	Inquire about Brunsen and the Kingsport. They are not here. Sent telex to Houston and London on above.
7-31-73	0900	Inquire about Brunsen and the Kingsport. Not here. Will return to London tomorrow.
8-1-73	0530	Depart Swansea for London.
	1400	Depart London for Amsterdam.
	1830	Arrive Den Helder, Netherlands.
8-2-73	1000	New streamer sections, lead-in cable, and other material in warehouse at Service International.
	2100	M/V Seismic Explorer arrived Den Helder.
8-3-73	0700	Remove 48-trace streamer, lead-in and spare sections from vessel and store on dock.
	1300	Burlie Brunsen of NUC arrived. Informed us that he and the Kingsport were in Barry--not Swansea.

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-4-73		Day off for crew.
8-5-73		Day off for crew.
8-6-73	0600	Started filling and weighting new streamer sections. Put new lead-in on reel. Install sat-nav antenna and run lead-in to instrument room.
8-7-73	0600	Continue working on streamer.
	1500	Start picking up twelve sections of 96-trace streamer off dock. These sections left by M/V Seismic Surveyor.
8-8-73	1200	Completed streamer installation.
	1400	Sat-nav equipment arrived.
	1600	Completed moving sat-nav equipment to instrument room.
8-9-73	0700	Crew cleaning vessel.
	1300	Miller and Barnett fly to London for meeting at ARC tomorrow.
	1600	Arrive Seisa office. G. Pavey, H. Aurand, and B. Brunsen there. Discuss various aspects of operation and meeting tomorrow.
8-10-73	1000	All above attend meeting at ARC . Discussion mostly centers around communications as far as we are concerned. The Seismic Explorer is given permission to use a VHF channel for communications with the Kingsport and Bullfinch during joint operations. Cmdr. Ramos also approves use of radar under these conditions.
	1300	Miller and Barnett depart meeting to return Den Helder.
	2000	Arrive Den Helder.
8-11-73	0900	Informed of arrival of partial shipment in Amsterdam. Paper work is incomplete and must wait for arrival of remainder before delivery.
	1300	Magnavox engineer Sy Shenkman arrived to check-out sat-nav equipment.
	1400	H. Aurand and B. Brunsen of NUC arrived.
	1430	Mike Morino with Lockheed arrived.
8-12-73	0800	Started check-out of navigation equipment.

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-12-73	Cont'd	Everything appears to be operating properly. Miller and Barnett discuss equipment lay-out, etc. with H. Aurand.
8-13-73	0800	Continue check-out of sat-nav equipment.
	1745	Total shipment arrived Den Helder. 127 pieces placed on board. Deck generator arrived and installed. New xtals for radio installed. These are per instrucions received at meeting at ARC.
8-14-73	0700	Began installation of NUC electronic equipment.
	0800	John Ehlers with NUC arrived.
	1400	Magnavox engineer departed.
8-15-73	0700	Continue installation of equipment.
8-16-73	0700	Continue as above.
8-17-73	0700	Continue as above.
	1200	Shipment including input and output patch panels arrived.
	1500	John Anwiler arrived. DeWayne White of NUC arrived.
8-18-73	0700	Continue installation. Both patch panels installed, wired and checked. Dale Ogden arrived.
8-19-73	0700	Continue installation. NUC beginning equipment check-out.
	1700	G. Bennett arrived.
8-20-73	0700	Start to secure equipment for sea.
8-21-73	0700	Complete securing equipment. Jim Rees of NUC on board.
	1200	Final shipment arrived.
8-22-73	0700	NUC checking all equipment
	1600	Department Den Helder for work area.
8-23-73		Underway - Sea calm.
8-24-73		Underway - Sea calm.
8-25-73	0700	Put streamer in water with approx. 200# on front end but no birds. About 500' of lead-in

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-25-73 Cont'd.

out. Calibrate D.I.'s at 100 ft. No. 4 D.I. inoperative. Streamer appears to be light. Will add two weights to each section and use 500# weight on tail of lead-in. Will try this tomorrow with birds and see if cable will stream at 500 ± ft. Found sections 2, 6, 7,71, 76 open. Spent approx 8 hours locating and repair. No. 76 open in first elastic section - replaced section. No. 6 and 7 found open in boot between AS 22-AS 23. Wires pulled out of pins in connector. No. 2 open in boot between AS 21-AS 22. Wires pulled out of connector pins. No. 71 isolated to AS 20. Cannot replace this section since it contains D. I. and no spare D.I. sections on board. Will look again at connectors tomorrow. Detailed cable configuration follows.

NUC wants group No. 1 nearest vessel. This will be taken care of at instrument room patch panel. Radar placed on stand-by--will be used now only for short intervals and for coordination with Kingsport and Bullfinch operations.

Cable configuration for NUC project.

1 1000 ft. lead-in cable
2 200 ft. elastic sections
24 100 m. live sections
1 200 ft. elastic section on tail

Each live section containes 4 groups - 12.5 m length - 25 m center to center - 8 phones per group - total 96 active groups.

D.I.'s located at the head of AS 1, 5, 10, 15, 20, 24. (D.I. in AS 15 is inoperative - appears shorted)

Bird rings located: Tail elastic section-near head end

Active	section	#4	near	tail	end
"	"	8	"	"	"
"	"	11	"	"	"
"	"	14	"	"	"
"	"	17	"	"	"
"	"	20	"	"	"
"	"	22	"	"	"

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-25-73	Cont'd.	Elastic section just ahead of AS 24 — Near center (use for weight only) Next E.S. — Near head end (use for weight only) Lead-in — Near tail end (use for weight only)
8-26-73	0700	Put streamer in with 500 # on lead-in. Front sections go to about 350 ft. - remainder less - tail especially light. Pick-up front and put on additional weight. Front end now will run at 450-500+ depending on speed. Remainder streams at ± 400-425 except tail. Pick-up and add weights along cable as needed.
	1000	Tried to find open in #71 - cannot - will go as is. No. 56 shows good on seis check, but no energy output. Will probably to as is.
	1400	Sighted what is probably Kingsport. No contact or attenpt to do so. Vessel is in immediate vacinity of calibration station.
8-27-73	0550	Radio contact with Kingsport - about 2± miles off port side.
	0605	Agree on Explorer course for calibration run by Kingsport. Explorer will run 090°. Source will be turned on at 0900. Explorer will run for 1± hour at 270° to get in position to lay streamer.
	0610	Depart Kingsport's position. She must maintain some headway for control - course more or less 270°.
	0635	Heard Bullfinch calling Kingsport.
	0720	Start laying cable.
	0800	Cable out - on course for cal. run.
	0815	Try to contact Kingsport to turn on source as vessels are closing.
	0900	Start run at approx. 4.5 mi. - will run long leg on other side.
	1212	Operation complete - passed Bullfinch during run.
	1355	Streamer on board - underway to site 2B.
	1600	Arrive area of site 2B.
	1730	Lay cable - start 5 mi. from beginning of leg 1.
	1815	Cable out - course 240° approaching start of leg 1.
	1900	Begin first leg of polygon at site 2B - event 004.
	2000	Come to course 120° for second leg - speed approx. 4 knots.
	2100	Come to 000° for third leg.
	2200	Come to 270° for fourth leg.
	2300	Come to 150° for fifth leg - drift appears to be to SE.

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-28-73	0000	Come to 030° for sixth leg.
	0100	Come to 300° for seventh leg.
	0200	Come to 180° for eighth leg.
	0300	Come to 060° for ninth leg.
	0400	Complete polygon at site 2B - event 004.
	0415	Pick-up streamer.
	0505	Cable on board - depart for area of site 2D - event 005.
	1000	Arrive area of 2D.
	1135	Laying cable - add some weights to front section.
	1240	Cable out - approx. 25-30 knot wind - 15-18 ft. seas.
	1400	On course 240° for leg one of polygon.
	1500	Come to 120° for leg two.
	1600	Come to 000° for leg three.
	1700	Come to 270° for leg four.
	1803	Come to 150° for leg five - delay for NUC to repair recorder.
	1900	Come to 030° for leg six - seas and wind down quite a bit.
	2000	Come to 300° for leg seven.
	2100	Come to 180° for leg eight.
	2200	Come to 060° for leg nine.
	2300	Complete polygon at site 2D - event 005. Cable running much better today - some trouble keeping front end at proper depth (450-500 ft.) due to wind and seas but overall looks good. Some legs of polygon too long (speed too high)due to above.
	2315	Pick up cable.
	2400	Cable on board - depart for area of site 2A.
8-29-73	0615	Arrive area of site 2A.
	0900	Lay cable - take a few weights off tail sections.
	1000	Start leg one - course 240° - Site 2A - event 006 - Sea State 7.
	1100	Come to 120° for leg two.
	1200	Come to 000° for leg three.
	1307	Come to 270° for leg four - delay for NUC to repair recorder.
	1400	Come to 150° for leg five.
	1500	Come to 030° for leg six.
	1600	Complete polygon at site 2A.
	1620	Pick-up cable - sea state about 6 - very difficult today to maintain headings due wind and sea conditions.
	1720	Cable on board - depart for area of site 2F.

(c) Table VII - DAILY OPERATIONS LOG - Continued

8-30-73	0400	Arrive area of site 2F - event 007
	0500	Lay cable - sea state 7+.
	0540	Tom Horsfield injured - fingers under strain gage cable - cable also broken - running SE for repairs.
	0630	Cable out - come to 195° - wind out of 270° - 35-40 knots.
	0715	Come to 220°.
	0800	Come to 200° for leg one - try to make good 180°.
	0900	Come to 220° for leg two - " " " " 210°.
	1000	Come to 247° for leg three " " " " 240°.
	1100	Come to 270° for leg four.
	1200	Come to 300° for leg five.
	1300	Come to 325° for leg six - try to make 330° good.
	1400	Come to 350° for leg seven " " " 000° " .
	1500	Come to 030° for leg eight.
	1600	Come to 060° for leg nine.
	1700	Come to 090° for leg ten.
	1800	Come to 120° for leg eleven.
	1900	Come to 150° for leg twelve.
	2000	Complete 12 - sided polygon at site 2F - event 007.
	2105	Cable on board - depart for area of site 3QB. Will run SW then SE because of seas.
	NOTE:	This event started two hours late due to sea conditions and injured man. This delay within limits of exercise plan. (per H. Aurand).
8-31-73		Wind up during the night. Running slowly SW into seas. At 0900 sea state 8 - forecast is for 7-9 for entire area. Will continue running SW for a time. At 1800 wind and seas still up. Forecast for gales over entire area. In discussion with H. Aurand decided to scratch event at 3QB and proceed to area of 3QD. Change course to run for this area - estimate of running time under these sea conditions is approx. 40 hours. Attempted to contact Kingsport or Bullfinch. Cannot see either on radar.
9-1-73		Wind and sea up during night. At 0700 sea state 9, wind out of SW at 40± knots. Wave heights 25-30 ft. with 40 ft. at times. Running SW at approx. 5 knots. Wind seems to be slowly shifting to west. At 1200 sea still same except shift to westerly. CC to 245° to stay out of trough.

(c) Table VII - DAILY OPERATIONS LOG - Continued

9-2-73		Wind and seas down during night. At 0700 increase speed to 10 knots on course for site 3QD.
	1430	Arrive area of site 3QD for event 011.
	1515	Start rigging for parachute mode of operation - some trouble with firing circuit (thru streamer) for explosive bolt.
	1830	Lay parachute and streamer.
	1920	Cable out - vessel now dead in water. Vessel head approx. 045° - streamer dead astern.
	2200	Kingsport began transmissions - 15 minutes on and 15 minutes off.
9-3-73		For this project at NUC's request: Group #1 near boat - Group #96 away from boat. On DFS Channel #1 near - Channel #48 far. Recorded all night - One 12 minute tape on DFS each two hours - 6 minutes with Kingsport transmission off and six minutes on. Drift is almost due east at 0.6 - 0.7 mile/hour.
	1100	Kingsport and Bullfinch approaching.
	1300	Go on aux. power for approx. one hour. Brunson says not much difference in noise level as opposed to ships generator (which is satisfactory for noise level).
	1410	Kingsport at site 3QD and makes turn for SE leg of run. All timing about right.
	1600	Can no longer spot tail bouy on radar or with glasses. All D.I.'s indicate in excess of 500 ft. Are beginning to get some high bursts of energy on random channels. Has the same appearance as a loose phone during normal operations.
	1930	Start main engines and take strain on cable in attempt to bring up - no luck but parachute is definitely in place and open. Decide, with Aurand, to remain as is. All equipment, except as mentioned above, appears to be operating satisfactorialy. Cannot see light on tail bouy.
9-4-73	0030	Last groups in streamer appear to be losing output.
	0045	Approx. last 31 groups have output of almost nothing - appears that end of streamer is sinking.
	0115	Fire explosive cutter to release chute.
	0140	Take in lead-in cable and remove weight.

(c) Table VII - DAILY OPERATIONS LOG - Continued

9-4-73	0150	Tow at clutch speed to bring streamer to near surface for pick-up.
	0220	Pick-up streamer.
	0300	Thirty-one groups on tail of streamer damaged beyond use due to excessive depth - two or three more of the next sections may be somewhat damaged - last two D.I.'s inoperative. Replace two sections so as to make good groups 56 and 71 which had been inoperative from the start. Group 56 indicates good on seis check but no output - group 71 open in A.S. no. 20. Replacing A.S. 20 means another D.I. out. This results in one D.I. at head of A.S. 24 and one at head of A.S. 10. Will operate this way.
	0800	Cable repaired and parachute rigged. Will leave bad sections on and use groups ahead of these on patch panel. Running on course of 265° to get back near area of 3QD - total drift has been approx. 20 miles east.
	0915	Lay cable.
	1015	Cable out in a dead calm cannot keep any tension on cable without wind - will keep engines running except during recording hours -- attempting to maintain about 1300-1500 lbs. on cable by using engines for brief periods in clutch speed.
	1330	Cable put out from SW to NE since prevailing winds are from SW. Wind (light) now starts from slightly west of north. By using one engine for brief periods and rudder attempting to swing to SE.
	1730	Ships head about 120° with cable dead astern. Still using engines as before since wind is not strong enough to hold tension. Shut down engines only for recording periods.
	2400	Operations at site 3QD complete (event 011)
9-5-73	0008	Fire cable cutter explosive to release chute.
	0015	Pick-up lead-in cable to remove weight - run 15 minutes and then pick-up cable.
	0055	Streamer on board - return to buoy to recover chute.
	0110	Pick-up buoy and recover chute.
	0130	Chute on board and secured.
	0132	Depart area - Exercise complete

(c) TABLE VIII

VESSEL CONTACT NUMBER	TIME & DATE (GMT)	OBJECT	METHOD OF CONTACT	CONTACT: BEARING - RANGE DEG.	N.M.	COURSE AND SPEED DEG.	KNOTS	CPA DEG.	N.M.	REMARKS
1	1300-26 Aug	Vessel	Visual	60°	6.5	200°	3.0	150°	3.0	EXPLORER came around to 190°, other vessel held course and speed
2 & 3	0400-27 Aug	Lights from two vessels	Visual	(2)340° (3)000°	5.0 12.0	Did not seem underway		(2)1.0		EXPLORER changed course to 350° at 0355 hours #3 identified as KINGSPORT
4	0634-27 Aug	Vessel	Radar	204°	7.0	Unknown			12.0	Believe vessel is BULLFINCH as she is calling KINGSPORT on VHF
5	1125-27 Aug	Vessel	Radar	170°	9.5	Unknown			9.5	Very small radar target, picked up every 3rd sweep
6	0335-28 Aug	Vessel	Visual	060°	10.0	Unknown			10.0	Light visable-unable to determine type-size vessel
7	1620-28 Aug	Vessel	Visual	030°	7.[illegible]	090°		000°	6.0	Appeared to be large container carring vessel
8	1433-29 Aug	USN Plane	Visual	300 feet overhead		220° Unknown		300 feet		4 engine prop plane appeared to have magnetometer boom hanging from tail
9	1040-3 Sept	Vessel	Radar	035°	6.2	090°	7.0		4.0	Radar contact in fog and rain, later determined to be BULLFINCH
10	1040-3 Sept	Vessel	Radar	060°	10.5	220°	7.0		2.5	Radar contact in fog and rain, later determined to be KINGSPORT

CONFIDENTIAL

TABLE IX

(U) LISTING OF TAPE REELS WITH OPERATING CONDITIONS

Reel No.	Date & Time (GMT)	Station	Event	Streamer: Mode	Streamer: Bearing Ship/Streamer	Streamer: Depth - Feet 1	2	3	4	5	6	Cable Tension lbs.	Vessel Speed Knots	Sea Conditions: Wave Height Feet	Wind Force Knots	Direction From	Total Gain dB	Instrument Settings: Filters Low High	Sample Rate (msec)	Record Length (min)	Comments
1	27 Aug 73 0948	23C	002	Tow	086°/086°	440	410	-	450	470	380	1700	4.0	8-10	15	280°	96	8/18 62/72	4	12	Total gain was 102 dB for first 4 min.
2	27 Aug 73 1018	23C	003	Tow	100°/100°	460	410	-	490	470	380	1700	4.0	8-10	15	280°	102	8/18 62/72	4	12	
3	27 Aug 73 1119	23C	[illegible]	Tow	095°/095°	4[illegible]5	440	-	450	470	375	1500	4.0	8-10	15	280°	102	8/18 62/72	4	12	
4	27 Aug 73 1200	23C	003	Tow	095°/095°	440	430	-	450	470	375	1700	4.0	8-10	15	280°	102	8/18 62/72	4	12	
5	27 Aug 73 1943	23	004	Tow	215.5°/215.5°	430	375	-	390	430	425	1700	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #1 of collapsed polygon
6	27 Aug 73 2043	23	004	Tow	173° 173°	490	392	-	415	450	435	1700	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #2
7	27 Aug 73 2143	23	004	Tow	002°/002°	445	370	-	365	400	410	1700	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #3
8	27 Aug 73 2243	23	004	Tow	123°/123°	425	350	-	390	425	420	1800	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg 4
9	27 Aug 73 2343	23	004	Tow	139.5°/139.5°	455	355	-	385	410	410	2000	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #5
10	28 Aug 73 0043	23	004	Tow	049°/049°	470	375	-	380	420	415	1800	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #6
11	28 Aug 73 0143	23	004	Tow	311°/311°	455	340	-	345	415	360	2000	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #7
12	28 Aug 73 0243	23	004	Tow	166°/166°	430	355	-	390	430	425	1900	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #8
13	28 Aug 73 0343	23	004	Tow	25[illegible].5°/20[illegible].5°	400	3[illegible]	-	[illegible]0	470	415	2100	4.0	8-10	10	270°	96	8/18 62/72	4	12	Leg #9
14	28 Aug 73 1443	2[illegible]	005	Tow	214.5°/214.5°	425	415	-	460	490	440	1900	3.5	15	20-25	200°	96	8/18 62/72	4	12	Leg #1 of collapsed polygon
15	28 Aug 73 1543	20	005	Tow	117.5°/117.5°	425	410	-	440	485	435	2100	3.5	15	20-25	200°	96	8/18 62/72	4	12	Leg #2
16	28 Aug 73 1643	20	005	Tow	019.5°/019.5°	435	470	-	465	485	435	1900	3.5	8-10	15	230°	90	8/18 62/72	4	12	Leg #3, Large vessel off stbd. bow, Range 8.5 mi., bearing 055° at start of recording. Range 12.4 mi., bearing 070° at end of recording

TABLE IX Continued

(u) LISTING OF TAPE REELS WITH OPERATING CONDITIONS

Reel No.	Date & Time(GMT)	Station	Event	Streamer Mode	Streamer Bearing Ship/Streamer	Streamer Depth - Feet 1 2 3 4 5 6	Cable Tension lbs.	Vessel Speed Knots	Sea Conditions Wave Height Feet	Sea Conditions Wind Force Knots	Sea Conditions Direction From	Instrument Settings Total Gain dB	Instrument Settings Filters Low High	Instrument Settings Sample Rate (msec)	Instrument Settings Record Length (min)	Comments
17	28 Aug 73 1745	2D	005	Tow	269.5°/269.5°	450 430 - 465 490 440	1900	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #4, Some ship noise
18	28 Aug 73 1845	2D	005	Tow	154°/154°	430 420 - 460 490 440	1900	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #5
19	28 Aug 73 1945	2D	005	Tow	031°/031°	425 410 - 460 485 440	1600	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #6
20	28 Aug 73 2045	2D	005	Tow	290.5°/290.5°	470 450 - 470 500 450	1600	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #7
21	28 Aug 73 2145	2D	005	Tow	180°/180°	450 425 - 460 490 450	2000	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #8
22	28 Aug 73 2245	2D	005	Tow	060°/060°	475 425 - 457 487 435	1900	3.5	8-10	15	230°	96	8/18 62/72	4	12	Leg #9
23	29 Aug 73 1045	2A	006	Tow	234°/234°	470 450 - 460 470 450	1900	4.0	15	30-40	240°	96	8/18 62/72	4	12	Leg #1 of collapsed polygon
24	29 Aug 73 1145	2A	006	Tow	118.5°/118.5°	420 415 - 460 480 465	1400	4.0	15	30-40	240°	96	8/18 62/72	4	12	Leg #2
25	29 Aug 73 1245	2A	006	Tow	019°/019°	430 420 - 460 485 450	1900	3.5	15-20	30-40	270°	96	8/18 62/72	4	12	Leg #3
26	29 Aug 73 1345	2A	006	Tow	276°/276°	457 435 - 460 490 465	2100	3.5	15-25	30-40	270°	96	8/18 62/72	4	12	Leg #4
27	29 Aug 73 1445	2A	006	Tow	138°/138°	410 410 - 455 475 455	1700	4.0	15 20	30 40	240°	96	8/18 62/72	4	12	Leg #5
28	29 Aug 73 1545	2A	006	Tow	033.5°/033.5°	460 435 - 480 480 460	1600	4.0	15	30-40	240°	96	8/18 62/72	4	12	Leg #6 Some possible ship noise
29	30 Aug 73 0845	2F	007	Tow	192°/192°	420 405 - 485 450 435	1700	4.0	20-25	35 40	350°	96	8/18 62/72	4	12	Leg #1 of 12-sided polygon, 12 seconds of all ones at start of tape, 30 seconds of bad data after ones
30	30 Aug 73 0945	2F	007	Tow	206°/206°	468 433 - 480 445 450	1500	4.0	20 25	35-40	350°	96	8/18 62/72	4	12	Leg #2
31	30 Aug 73 1045	2F	007	Tow	239°/239	460 430 - 438 440 430	1700	4.0	20-25	35-40	330°	96	8/18 62/72	4	12	Leg #3
32	30 Aug 73 1145	2F	007	Tow	270°/270°	450 420 - 475 450 440	2000	4.0	20-25	35-40	330°	96	8/18 62/72	4	12	Leg #4
33	30 Aug 73 1245	2F	007	Tow	299.5°/299.5°	450 420 - 430 460 455	1700	4.0	20-25	35-40	300°	96	8/18 62/72	4	12	Leg #5

UNCLASSIFIED

TABLE IX Continued

(u) LISTING OF TAPE REELS WITH OPERATING CONDITIONS

Reel No.	Date & Time (GMT)	Station	Event	Mode	Bearing Ship/Streamer	Streamer 1 2 3 4 5 6	Cable Tension lbs.	Vessel Speed Knots	Sea Conditions: Wave Height Feet	Wind Force Knots	Direction From	Instrument Settings: Total Gain dB	Filters Low High	Sample Rate (msec)	Record Length (min)	Comments
36	30 Aug 71 1345	27	007	Tow	318°/317°	417 415 - 470 420 410	1800	4.0	20-25	35-40	300°	96	8/18 62/72	4	12	Leg #6
35	30 Aug 71 1445	27	007	Tow	357°/357°	430 435 - 470 410 400	1800	4.0	20-25	30-35	300°	96	8/18 62/72	4	12	Leg #7
34	30 Aug 71 1545	27	007	Tow	030°/030°	410 400 - 470 435 420	2100	4.0	20-25	30-35	300°	96	8/18 62/72	4	12	Leg #8
33	30 Aug 71 1645	27	007	Tow	067°/067°	470 435 - 485 450 435	2000	4.0	20-25	30-35	300°	96	8/18 62/72	4	12	Leg #9
32	30 Aug 71 1745	27	007	Tow	087°/087°	450 415 - 475 465 450	1600	4.0	20-25	20-25	270°	96	8/18 62/72	4	12	Leg #10
31	30 Aug 71 1845	27	007	Tow	118.5°/118.5°	415 410 - 485 450 440	2000	4.0	10-15	15	245°	96	8/18 62/72	4	12	Leg #11
42	30 Aug 71 1945	27	007	Tow	147.5°/147.5°	435 420 - 480 445 445	1700	4.0	10-15	10-15	225°	96	8/18 62/72	4	12	Leg #12
41	1 Sept 71 0057	300	011	Parachute	058°/059	400 380 - 470 480 480	1200 1400	0.6 0.7	4-5	5-8	SW	102	8/18 62/72	4	12	First six minutes with no signal from KINGSPORT and last six minutes with signal on
42	1 Sept 71 0257	300	011	Parachute	063°/063	450 410 - 490 500 500	1100 1200	0.6 0.7	4-5	5-8	SW	102	8/18 62/72	4	12	
43	1 Sept 71 0457	300	011	Parachute	110°/085°	500 500 - 500 500 500	1100	0.6 0.7	3-4	5-8	SW	108	8/18 62/72	4	12	
44	1 Sept 71 0658	300	011	Parachute	075°/064°	475 500 - 500 500 500	1150	0.6 0.7	3-4	5-8	SW	102	8/18 62/72	4	12	
45	1 Sept 71 0858	300	011	Parachute	035°/025°	500 500 - 500 500 500	1100	0.6 0.7	3-4	5-8	SW	102	8/18 62/72	4	12	
46	1 Sept 71 1058	300	011	Parachute	056°/078°	470 500 - 500 500 500	1100	0.6 0.7	4-5	5-8	SW	102	8/18 62/72	4	12	Both KINGSPORT and BILLFINCH approaching
47	1 Sept 71 1256	300	011	Parachute	060°/040°	450 500 - 500 500 500	1100	0.6 0.7	3-4	5-8	SW	102	8/18 62/72	4	12	Vessels still in area
48	1 Sept 71 1456	300	011	Parachute	087°/035°?	450 500 - 500 500 500	1150	0.6 0.7	4-5	6-8	SW	102	8/18 31-62/72	4	12	Vessels still in area, Group 96 and 54-44 recorded with hi-cut filter at 31 Hz. Tail bouy reflector not clear on radar

TABLE IX Continued

(a) LISTING OF TAPE REELS WITH OPERATING CONDITIONS

Event No.	Date & Time (GMT)	Blasting	Event	Mode	Heading Ship/Streamer	Streamer 1	2	3	4	5	6	Cable Tension lbs.	Vessel Speed Knots	Sea Conditions: Wave Height Feet	Wind Force Knots	Direction From	Instrument Settings: Total Gain dB	Filters Low	High	Sample Rate (msec)	Record Length (min)	Comments
	/3	QD	011	Parachute	040°/040°	500	500	-	500	500	500	1050	0.6 0.7	4-5	6-8	SW	102	8/18	62/72	4	12	
50	3 Sept 73 1839	JQD	011	Parachute	110°/?	500	500	-	500	500	500	1150	0.6 0.7	4-6	6-8	SW	102	8/18	62/72	4	12	Recording started early, first six minutes with signal on and last six with source off. Cannot see tail bouy
51	3 Sept 73 2056	JQD	011	Parachute	050°/?	500	500	-	500	500	500	1300 1400	0.6 0.7	2-3	4-5	SW	102	8/18	62/72	4	12	
52	3 Sept 73 2254	JQD	011	Parachute	060°/?	500	500	-	500	500	500	1300 1400	0.6 0.7	3-4	3-5	SW	102	8/18	62/72	4	12	
53	4 Sept 73 1257	JQD	011	Parachute	054°/018°	500	-	-	385	-	-	1050 1100	0.5	3-4	1-2	-	108	8/18	62/72	4	12	D.I.'s No. 2,3,5, and 6 inoperative
54	4 Sept 73 1457	JQD	011	Parachute	118°/052°	500	-	-	455	-	-	1100 1200	0.5	2-3	-	-	102	8/18	62/72	4	12	
55	4 Sept 73 1654	JQD	011	Parachute	095°/095°	410	-	-	430	-	-	1050 1100	0.5	2-3	-	-	108	8/18	62/72	4	12	
56	4 Sept 73 1857	JQD	011	Parachute	120°/120°	450	-	-	450	-	-	1150 1280	0.5	2-3	-	-	102	8/18	62/72	4	12	
57	4 Sept 73 2056	JQD	011	Parachute	120°/120°	400	-	-	450	-	-	1200	0.5	4-5	-	-	102	8/18	62/72	4	12	
58	4 Sept 73 2257	JQD	011	Parachute	115°/110°	450	-	-	450	-	-	1100	0.5	4-5	2-3	N	102	8/18	62/72	4	12	
59	4 Sept 73 2365	JQD	011	Parachute	-/-	425	-	-	450	-	-	1200	0.5	3-4	2-3	N	102	8/18	62/72	4	12	Exercise Complete

UNCLASSIFIED

TABLE X

(u) CABLE GROUPS IN USE & TAPE CHANNEL ASSIGNED

STATION 2BC — EVENT 002

Array Calibration
Reels No. 1 through 4
Cable groups in use - No. 23 (far group) through No. 70 (near group)
Group No. 23 recorded on tape channel No. 48
Group No. 70 recorded in tape channel No. 1

STATION 2B — EVENT 004

Collapsed Polygon
Reels No. 5 through 13
Cable groups in use - No. 23 (far group) through No. 70 (near group)
Group No. 23 recorded on tape channel No. 48
Group No. 70 recorded on tape channel No. 1

STATION 2D — EVENT 005

Collapsed Polygon
Reels No. 14 through 22
Cable groups in use - No. 8 (far group) through No. 55 (near group)
Group No. 8 recorded on tape channel No. 48
Group No. 55 recorded on tape channel No. 1

STATION 2A — EVENT 006

Collapsed Polygon
Reels No.23 through 28
Cable groups in use - No. 8 (far group) through No. 55 (near group)
Group No. 8 recorded on tape channel No.48
Group No. 55 recorded on tape channel No. 1

STATION 2F — EVENT 007

Twelve Sided Polygon
Reels No. 29 through 40
Cable groups in use - No. 8 (far group) through No. 55 (near group)
Group No. 8 recorded on tape channel No 48
Group No. 55 recorded on tape channel No. 1

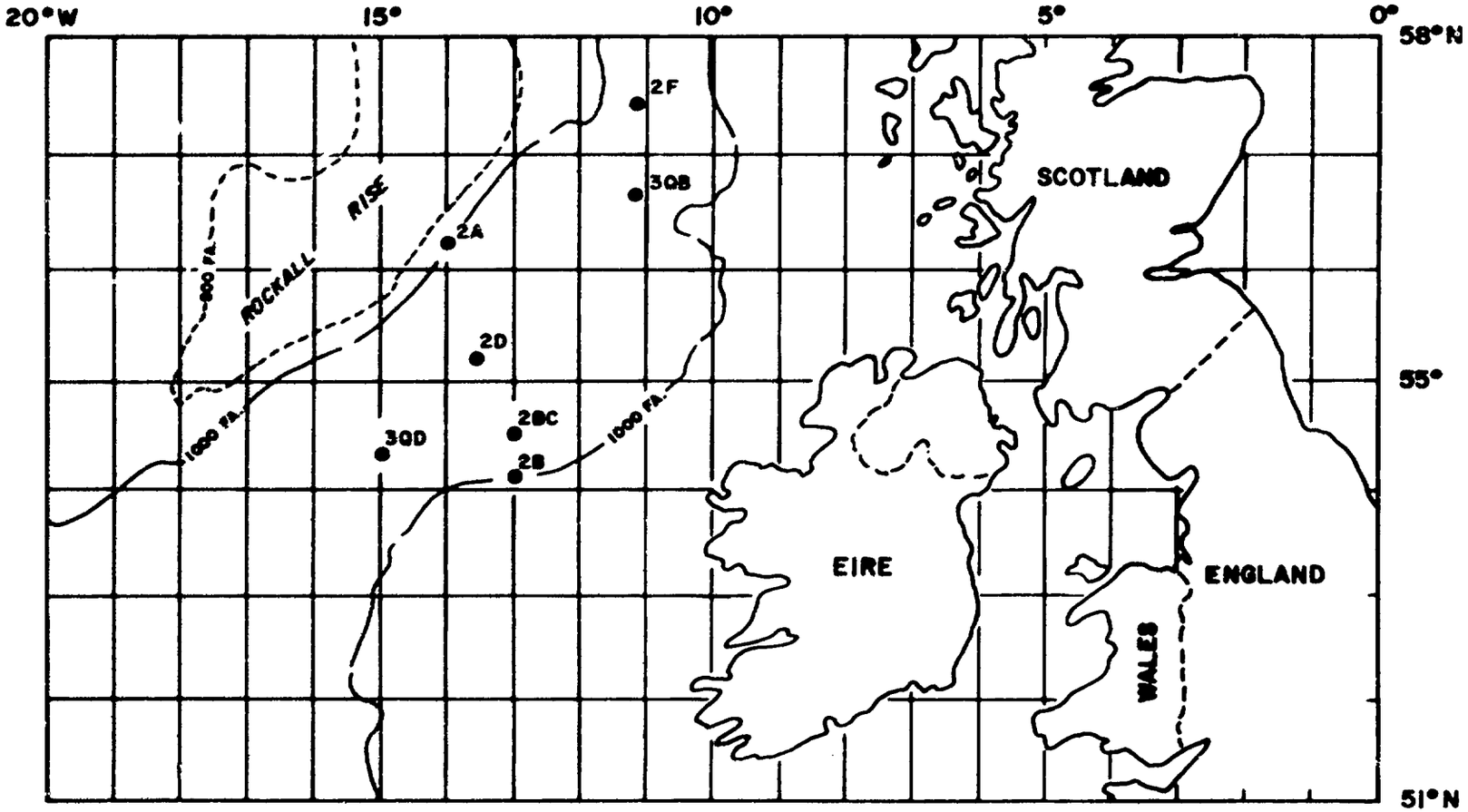
(u) TABLE X Cont'd.

CABLE GROUPS IN USE & TAPE CHANNEL ASSIGNED

STATION 3QD EVENT 011

Parachute Mode
Reels No. 41 through 52
Cable groups in use - No. 1 (far group), No. 9 through No. 54, No. 96 (near group)
Group No. 1 recorded on tape channel No. 48
Group No. 9 recorded on tape channel No. 47
Group No. 54 recorded on tape channel No. 2
Group No. 96 recorded on tape channel No. 1

Reels No. 53 through 59
Cable groups in use - No. 37 (far group) through No. 84 (near group)
Group No. 37 recorded on tape channel No. 48
Group No. 84 recorded on tape channel No. 1



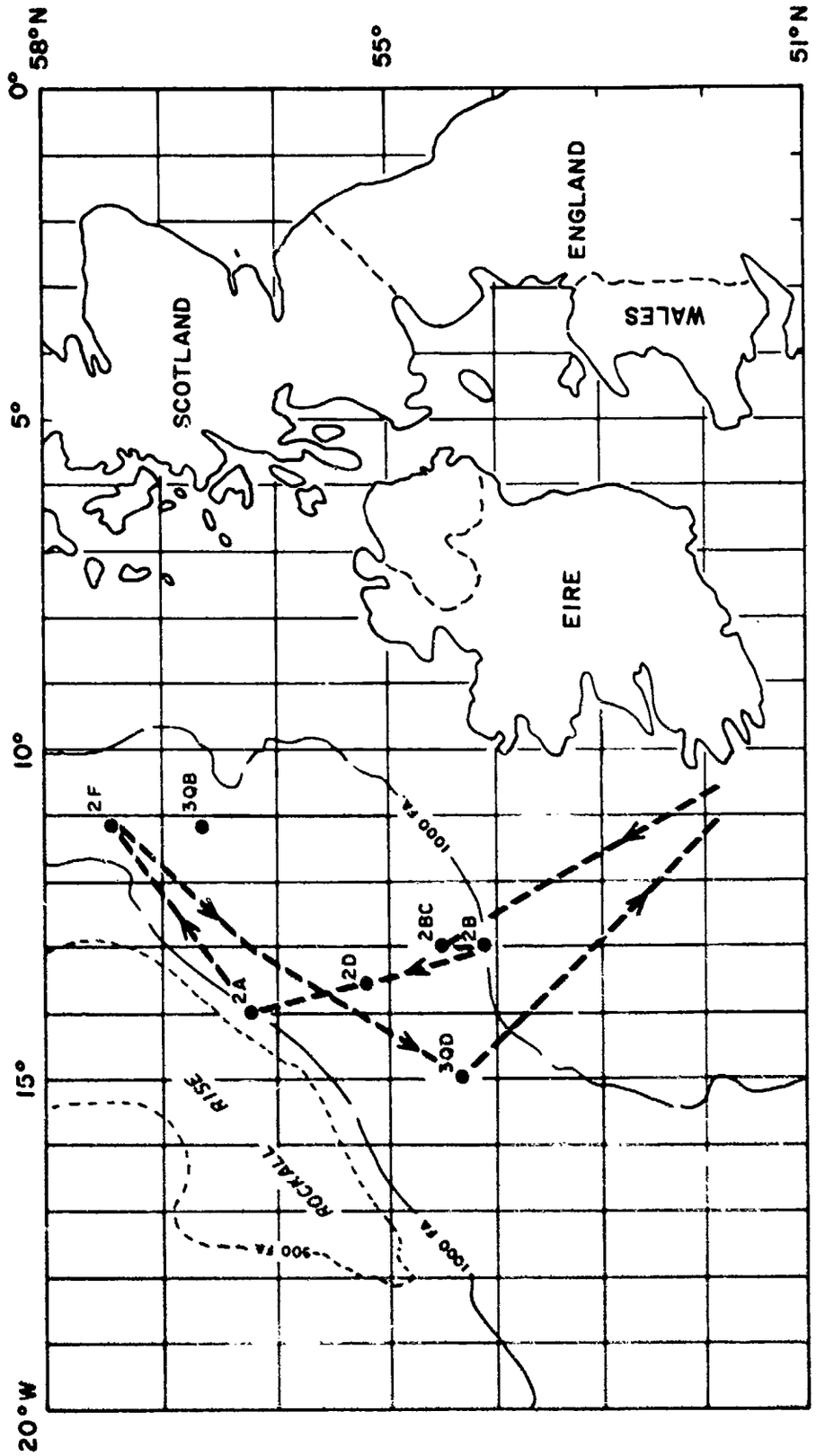
LOCATION PLAT

for

Exercise Square Deal

SITES OCCUPIED BY M/V SEISMIC EXPLORER

Figure 1



TRACK PLOT
for
Exercise Square Deal
BY
M/V SEISMIC EXPLORER

Figure 2

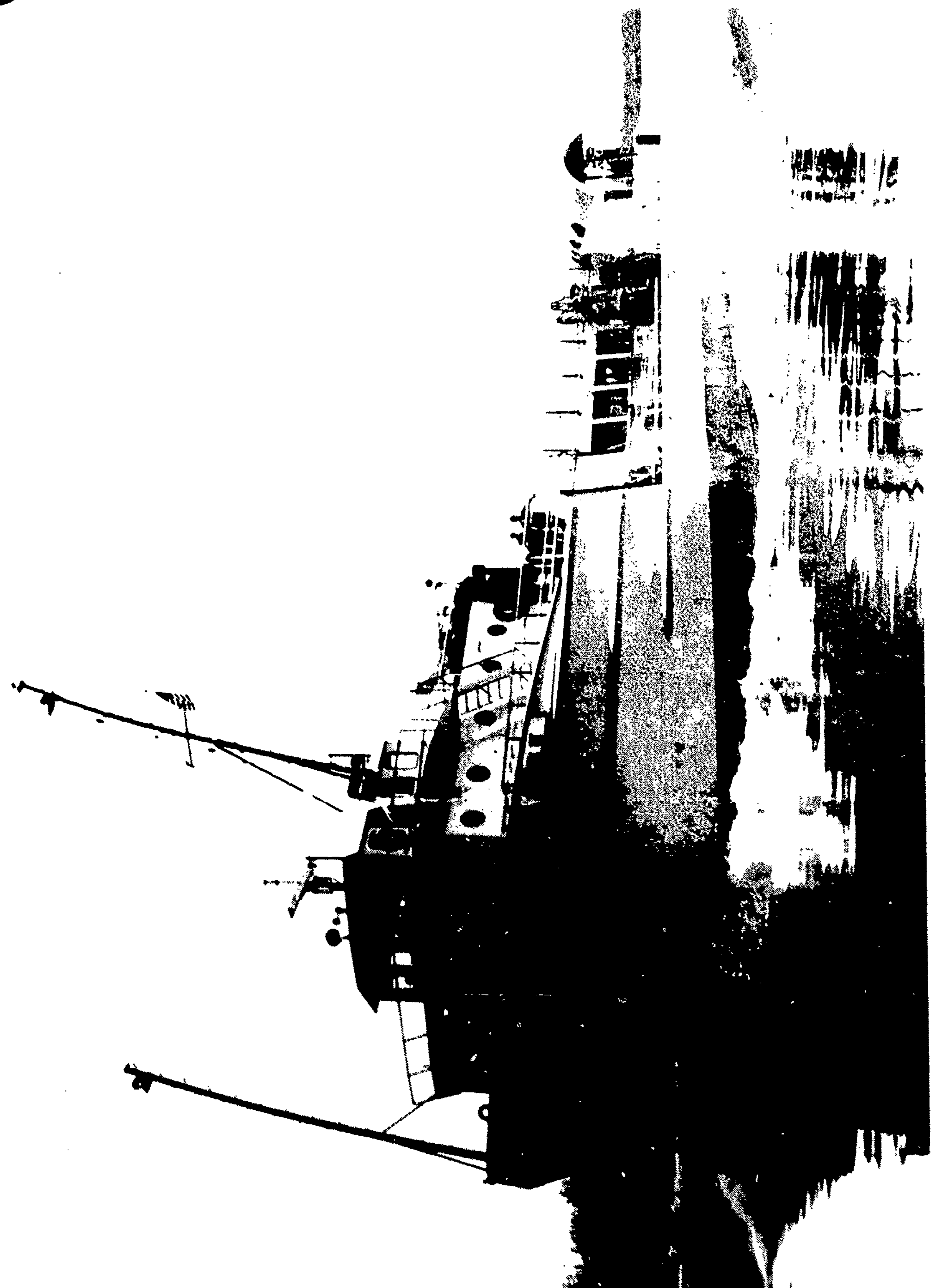
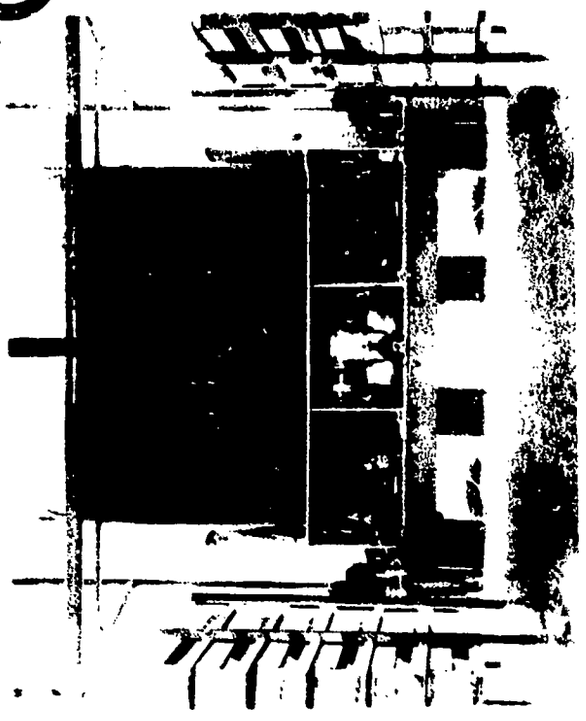
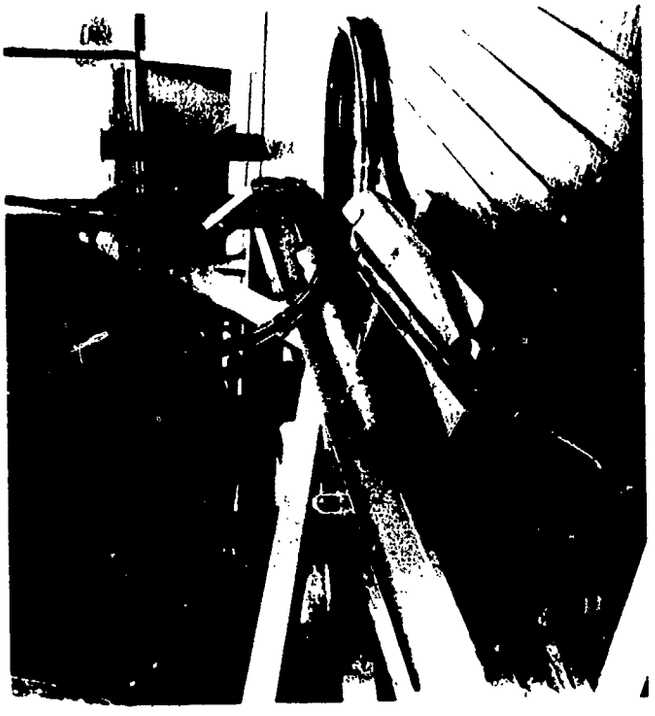


Figure 3





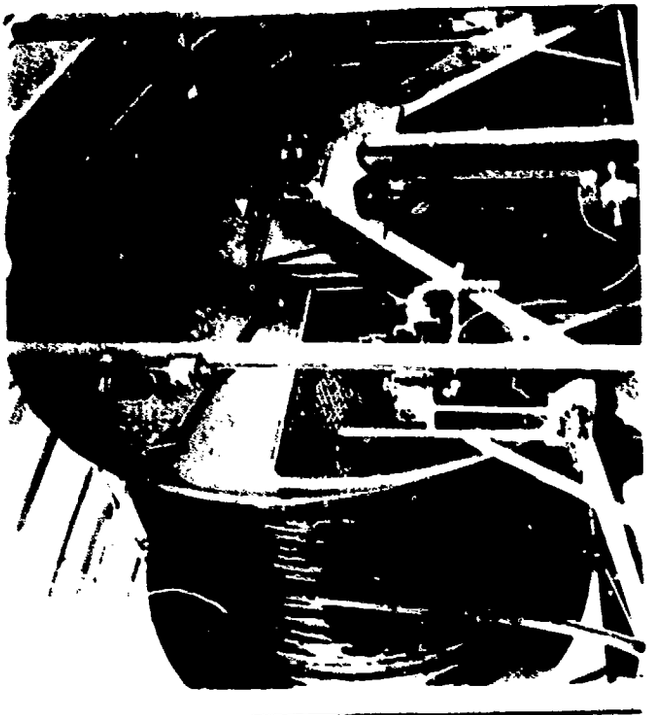
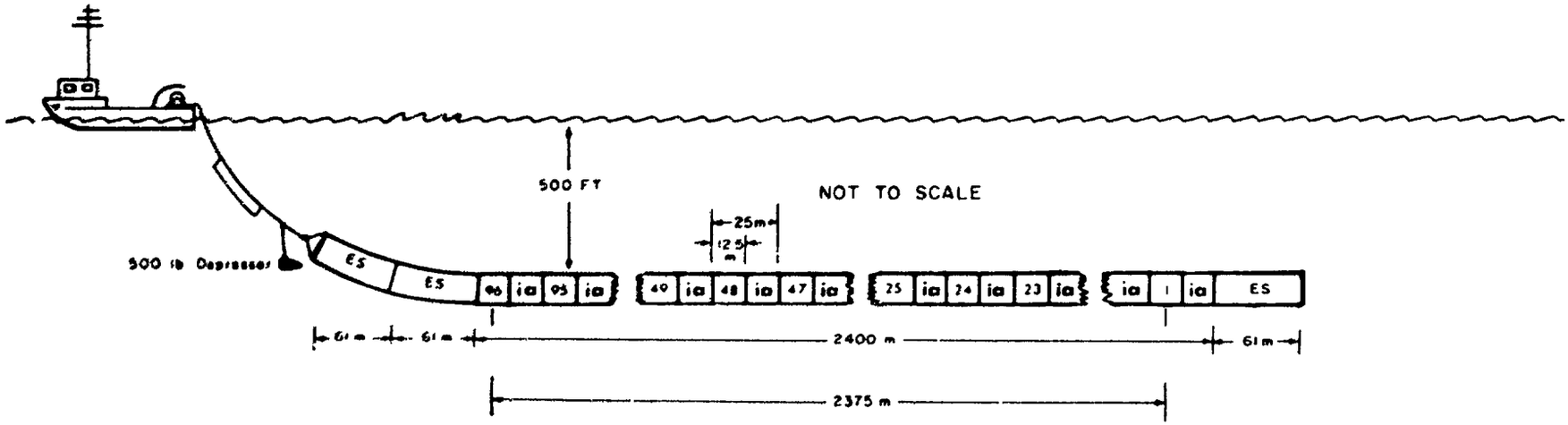


Figure No. 4



ia INACTIVE SECTION
ES ELASTIC SECTION

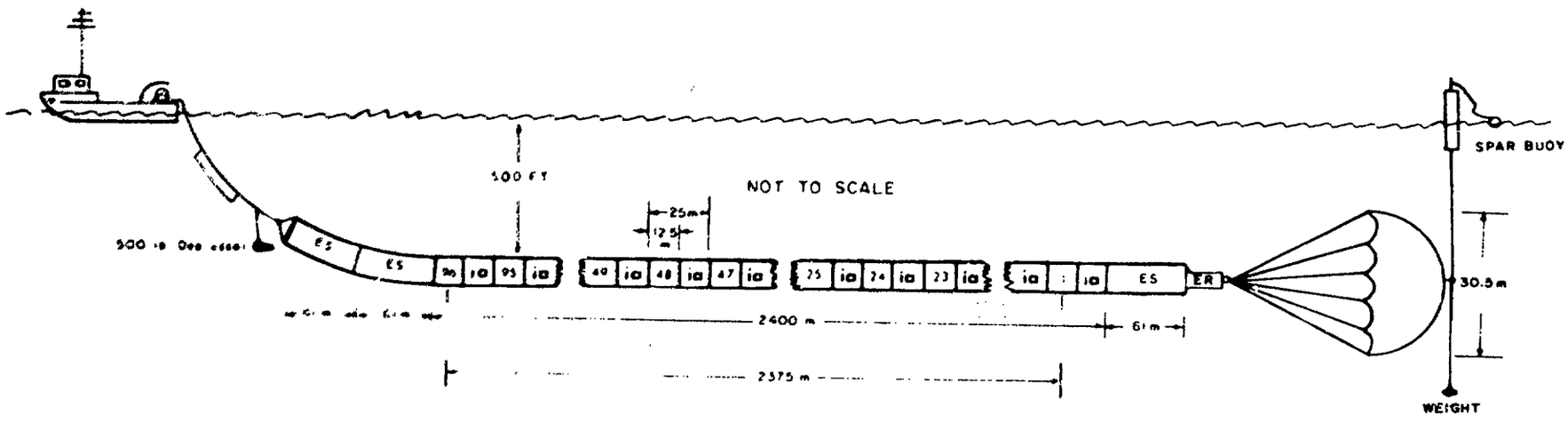
SQUARE DEAL

STREAMER DIAGRAM

TOW MODE

FIGURE 5

UNCLASSIFIED



10	INACTIVE SECTION
ES	ELASTIC SECTION
ER	EXPLOSIVE RELEASE

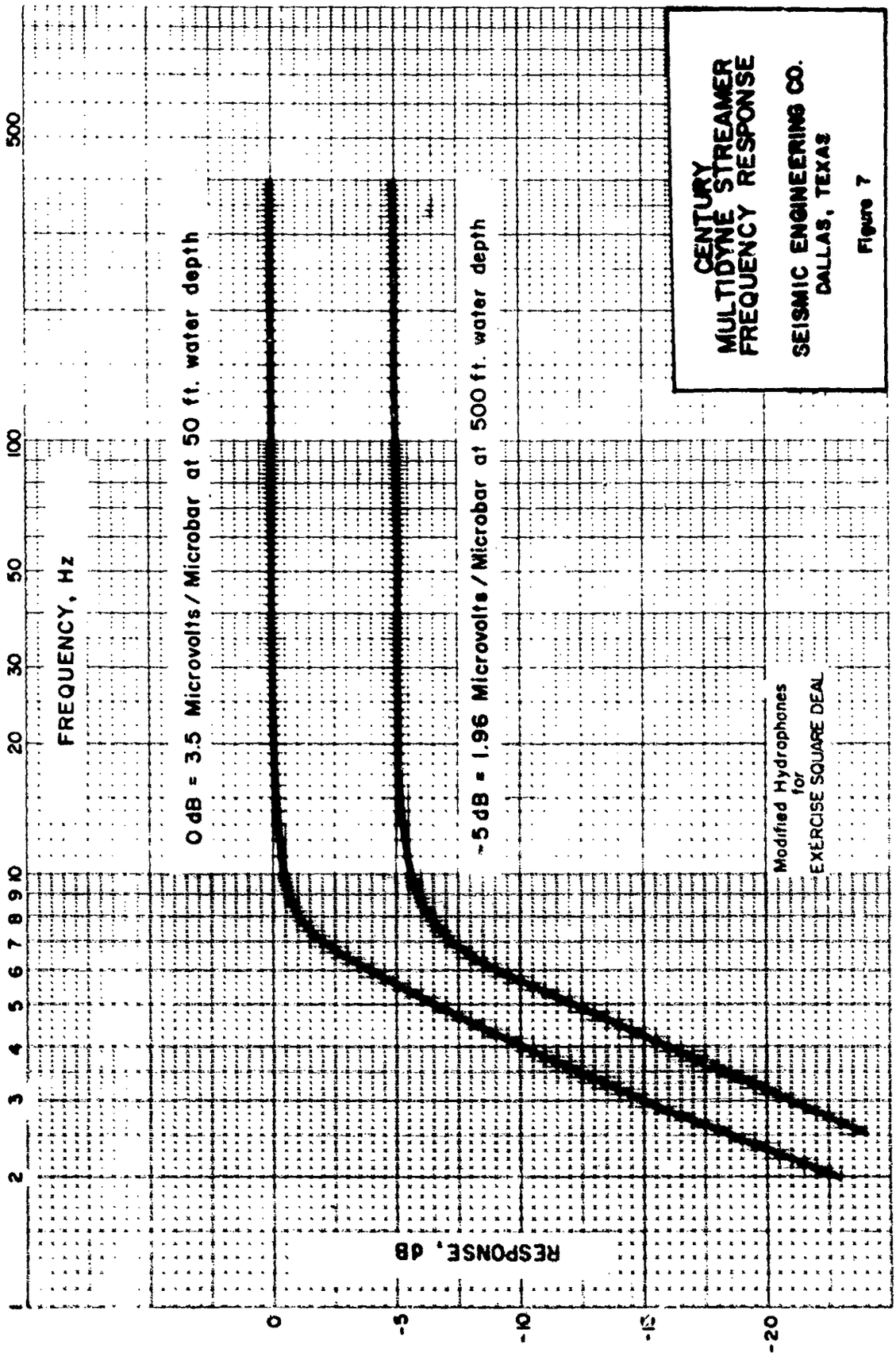
SQUARE DEAL

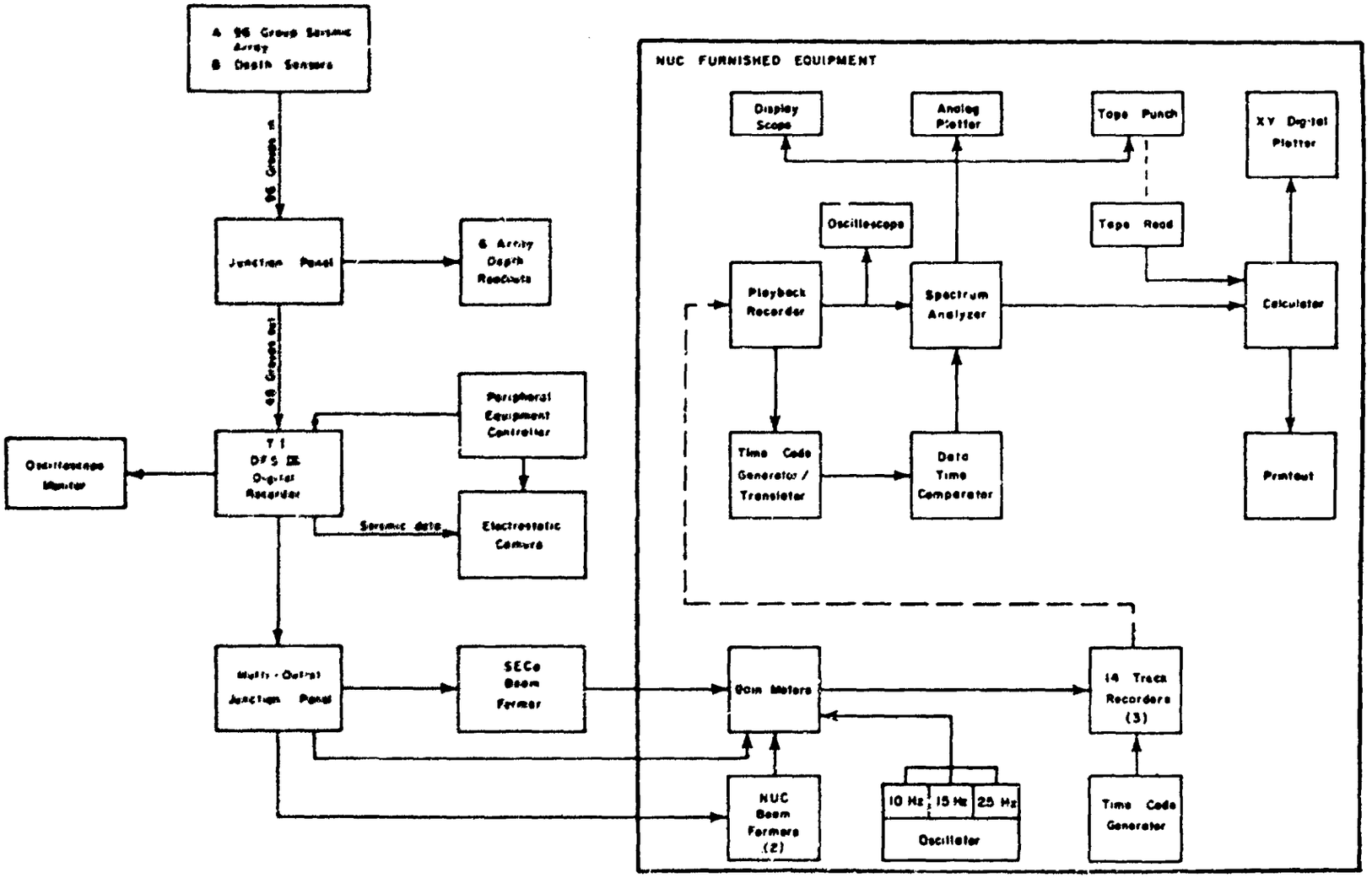
STREAMER DIAGRAM

PARACHUTE MODE

FIGURE 6

UNCLASSIFIED


CENTURY
MULTIDYNE STREAMER
FREQUENCY RESPONSE
SEISMIC ENGINEERING CO.
DALLAS, TEXAS
Figure 7
FREQUENCY, Hz
1
2
3
4
5
6
7
8
9
10
20
30
50
100
500
RESPONSE, dB
0
-5
-10
-15
-20
0 dB = 3.5 Microvolts / Microbar at 50 ft. water depth
-5 dB = 1.96 Microvolts / Microbar at 500 ft. water depth
Modified Hydrophones
for
EXERCISE SQUARE DEAL



SQUARE DEAL

DATA ACQUISITION SYSTEM

BLOCK DIAGRAM

Figure 8

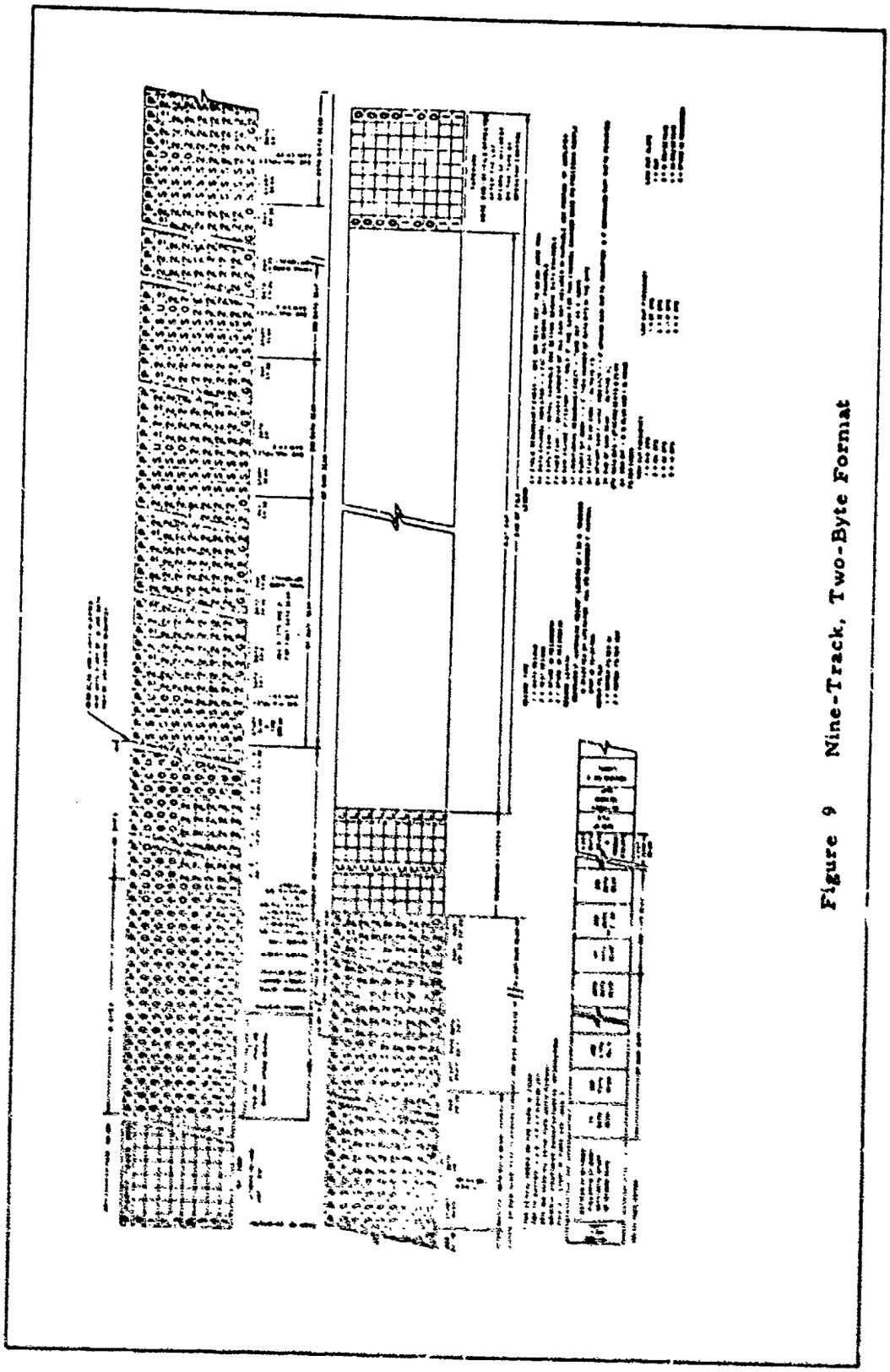


Figure 9 Nine-Track, Two-Byte Format

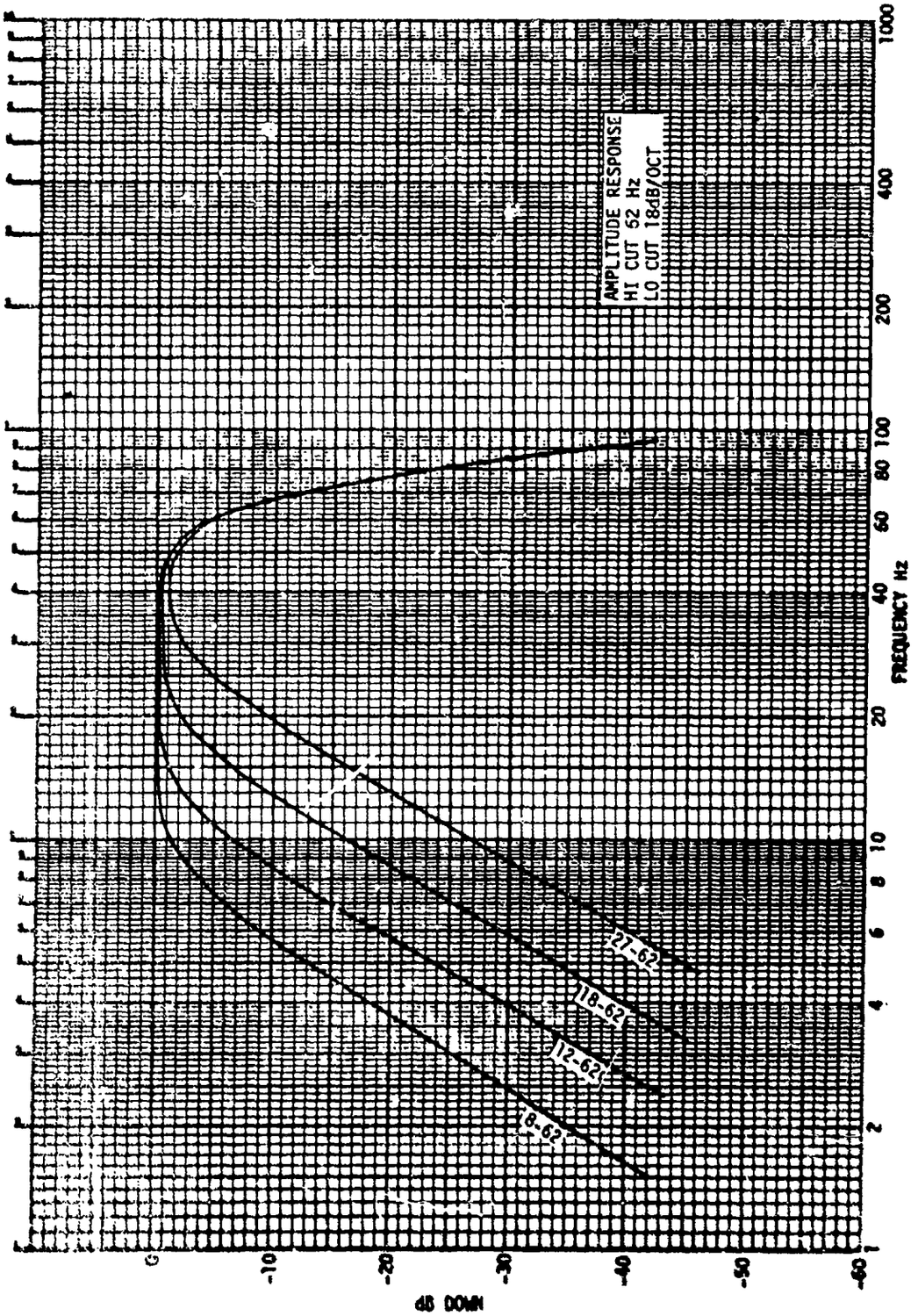


Figure 10 Amplitude Response, 18 dB/Oct., 62 Hz

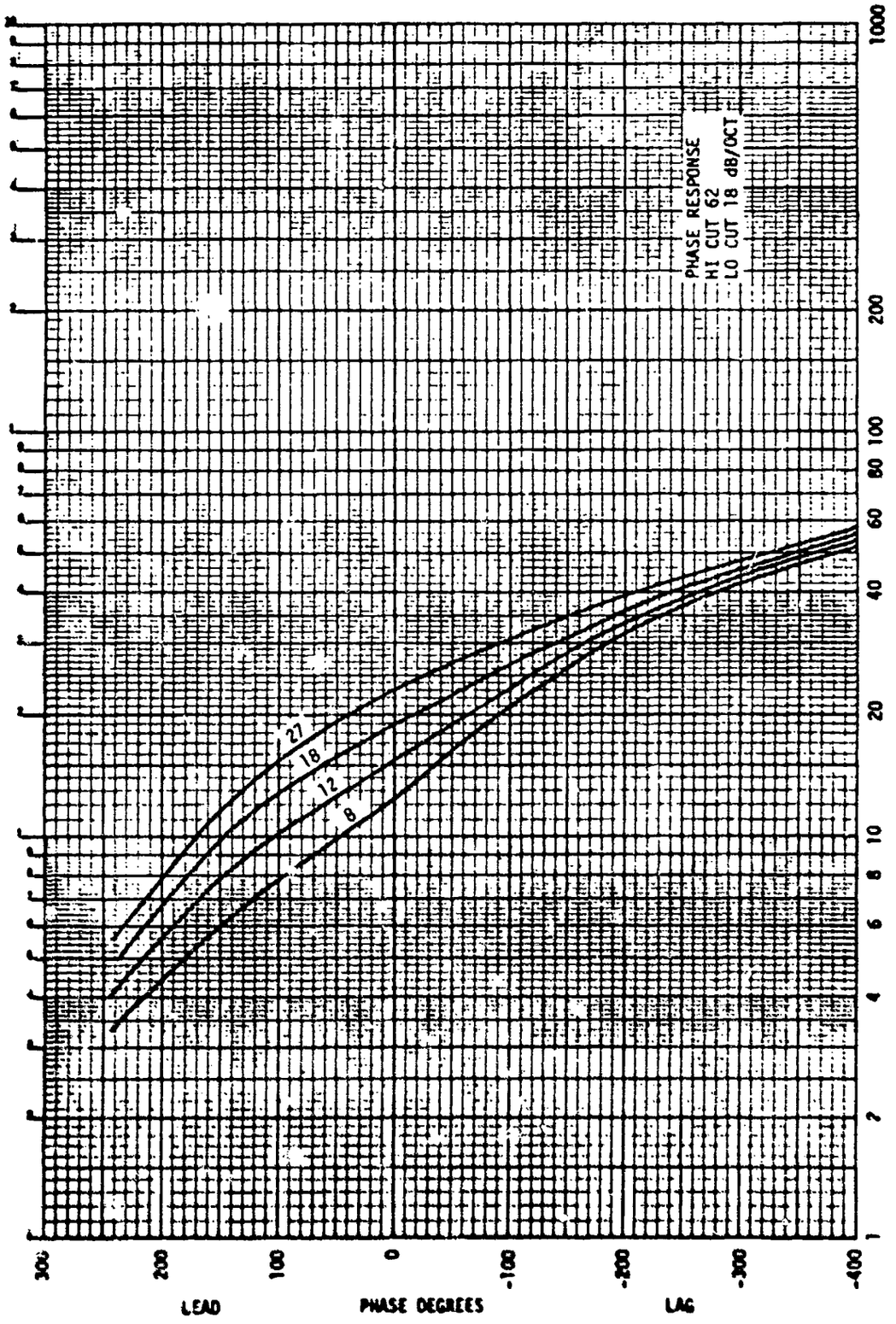
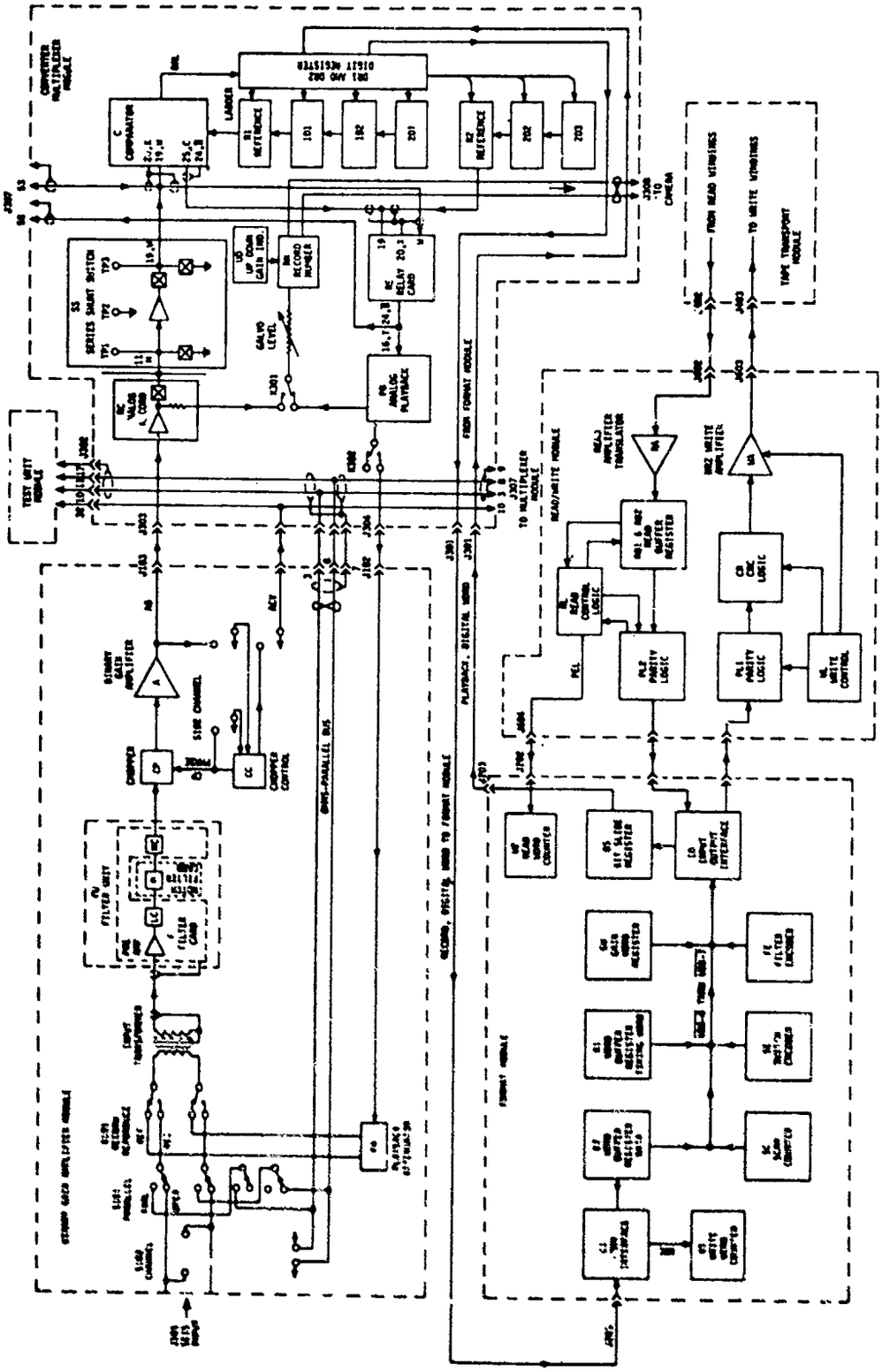


Figure 11 Phase Response, 18 dB/Oct., 62 Hz



Nine Track Signal Flow
Figure No. 12

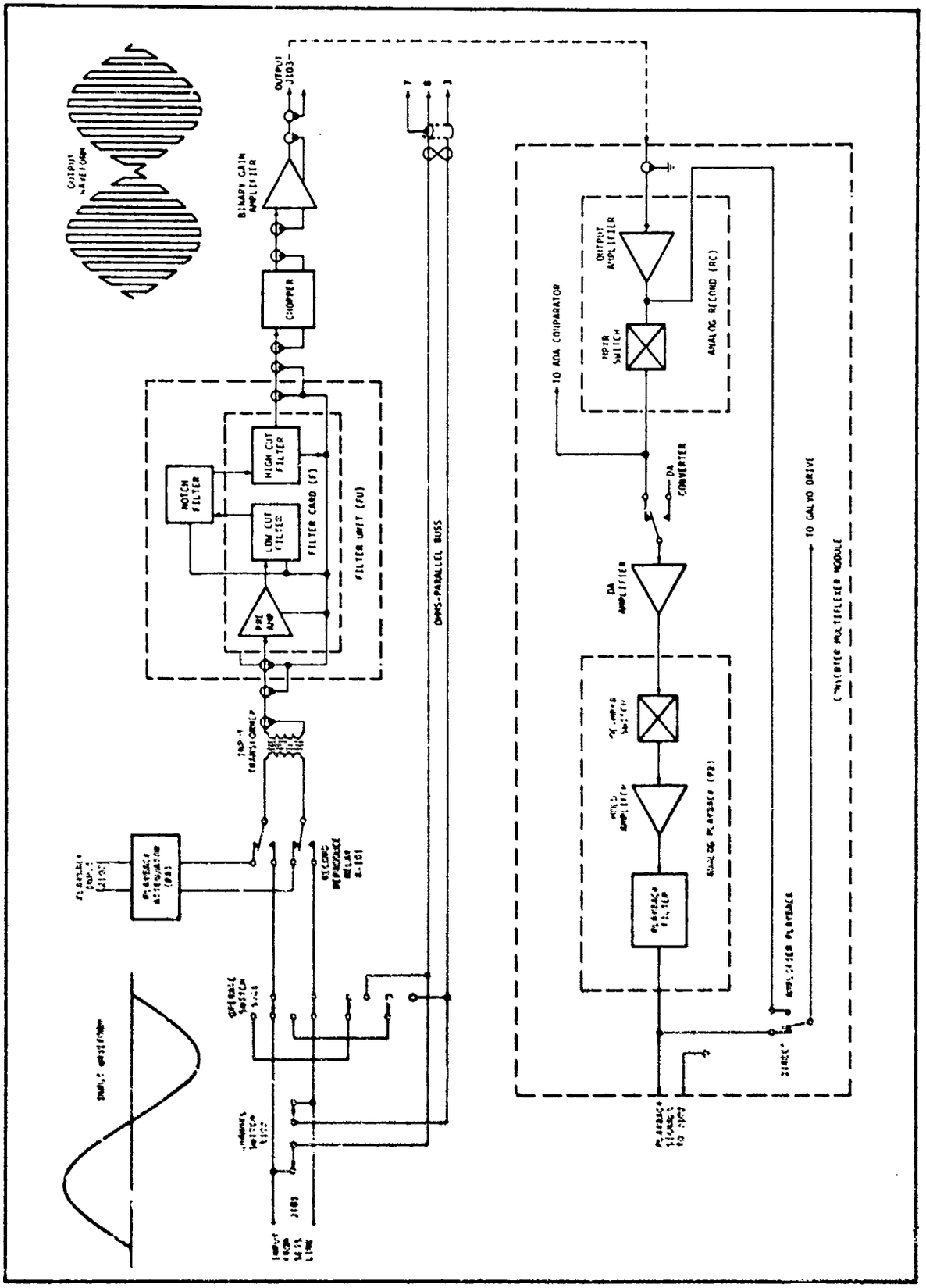
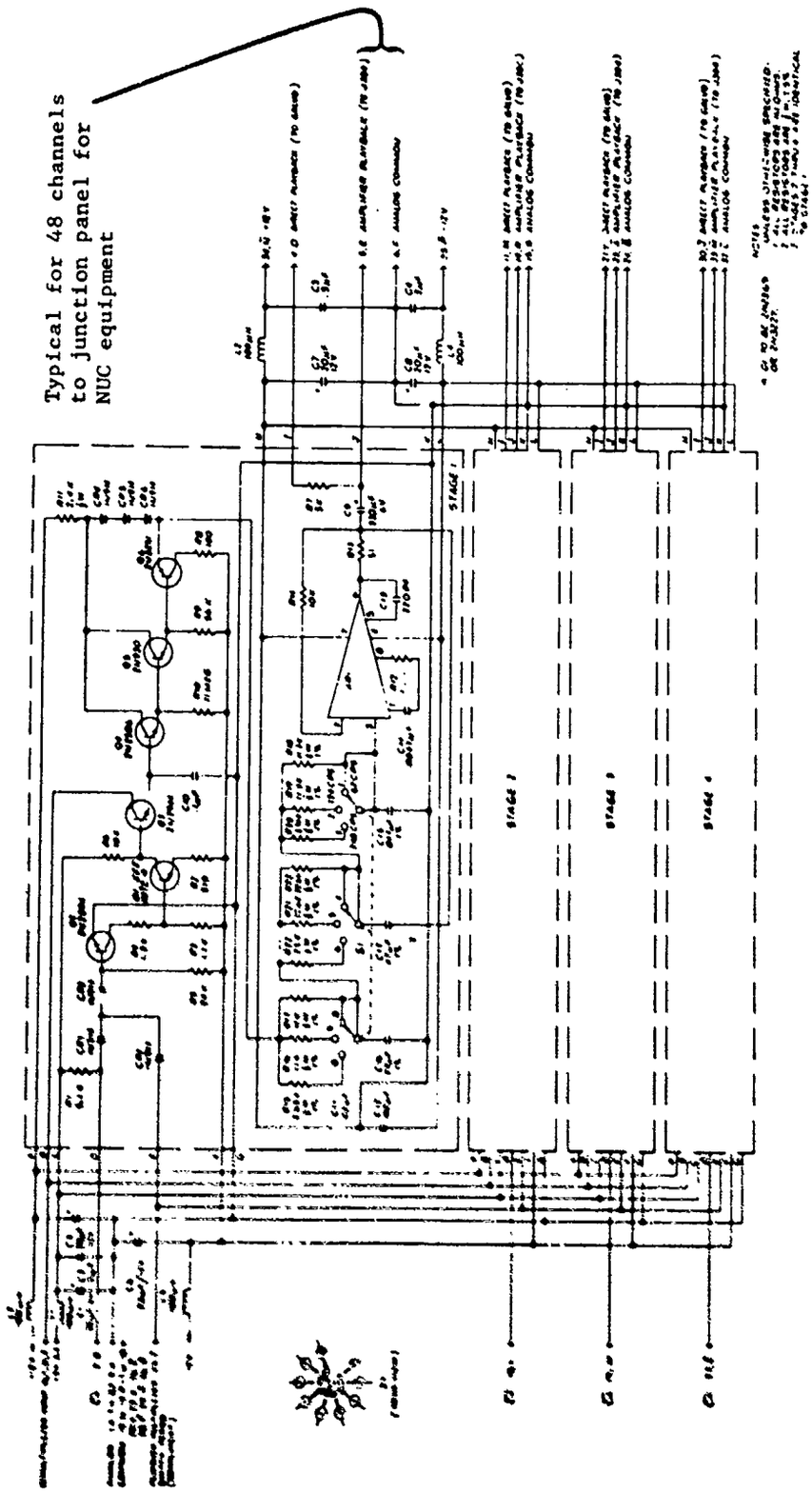


Figure 13 Single Channel Signal Flow



Schematic, Analog Playback
Figure No. 14

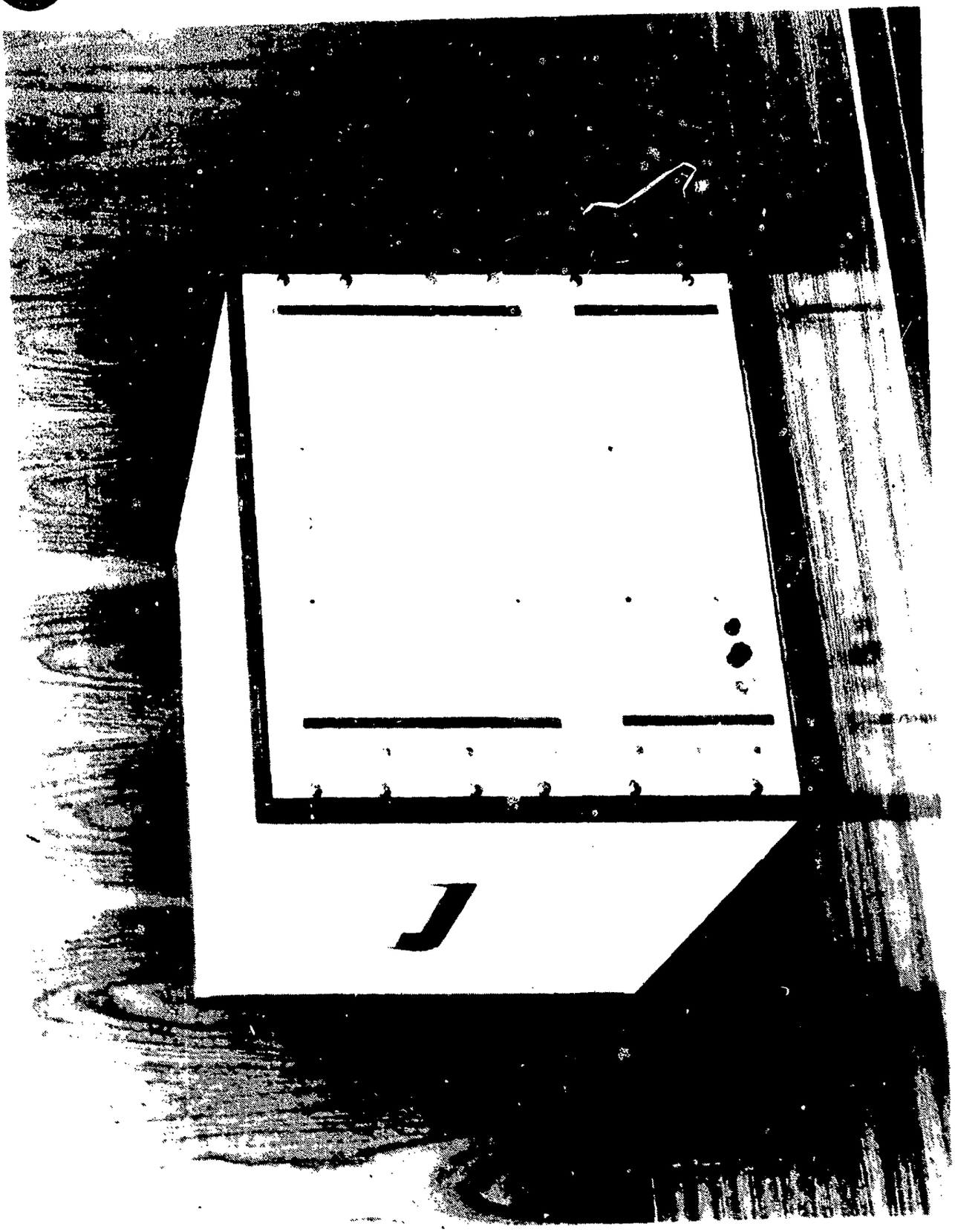


Figure 15 - SECo Beamformer - Front View

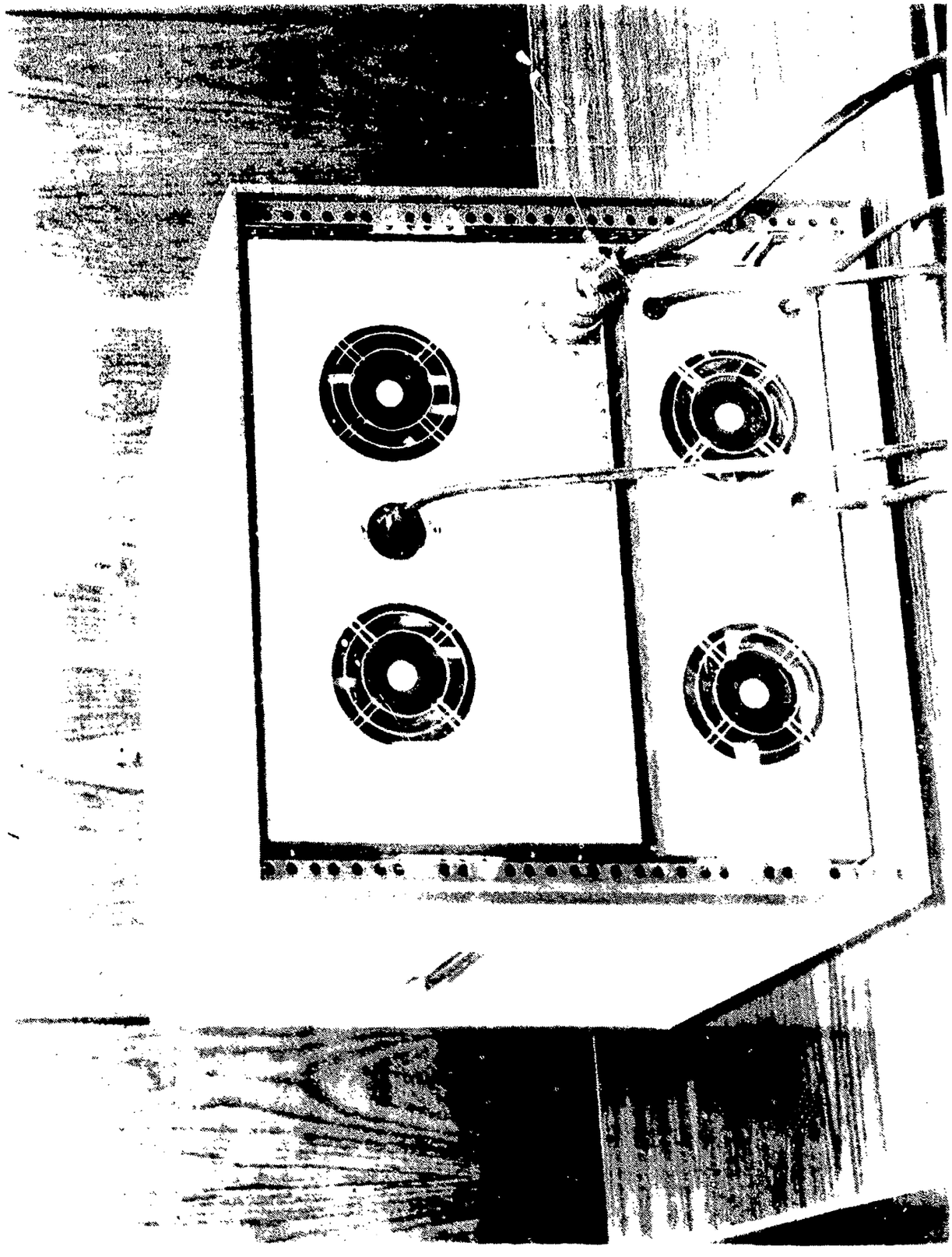


Figure 16 - SECo Beamformer - Back View

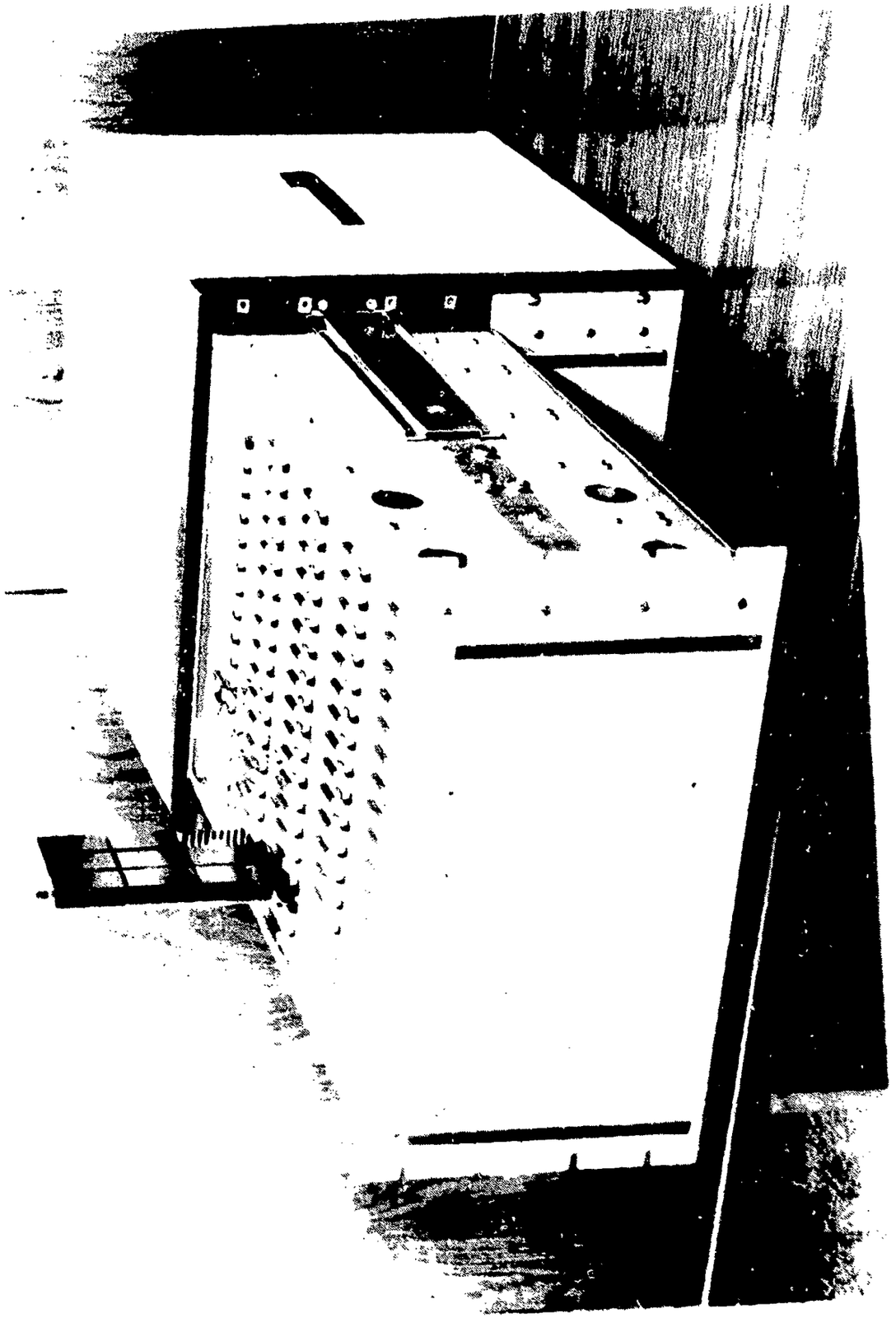
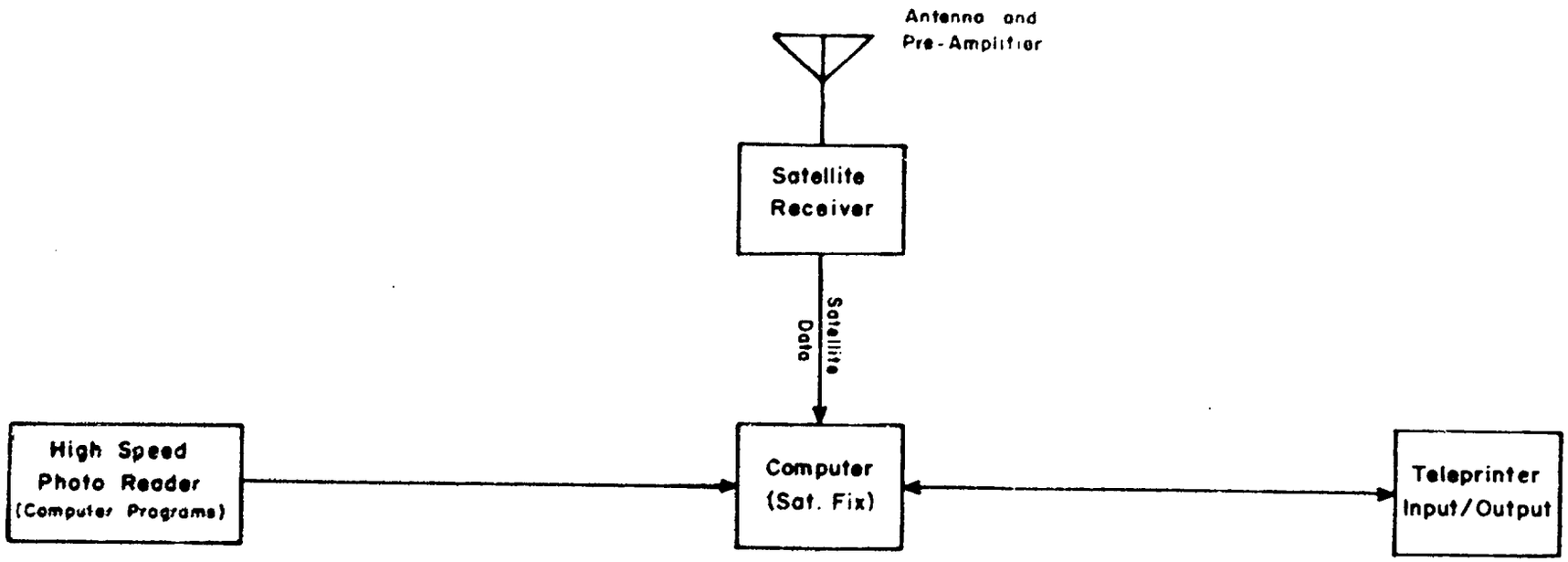


Figure 17 - SECo Beamformer - Drawer Layout



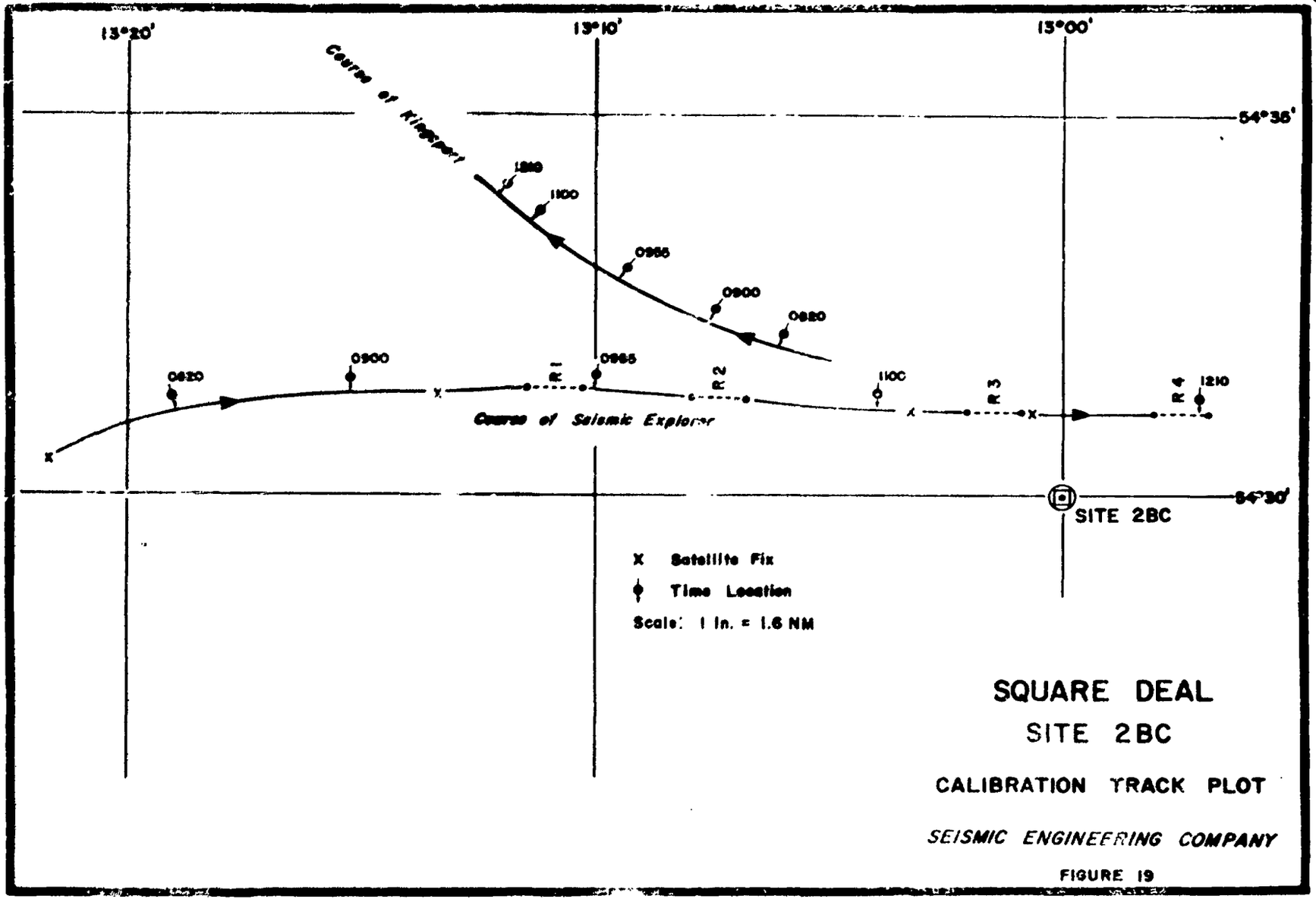
SQUARE DEAL

NAVIGATION SYSTEMS
BLOCK DIAGRAM

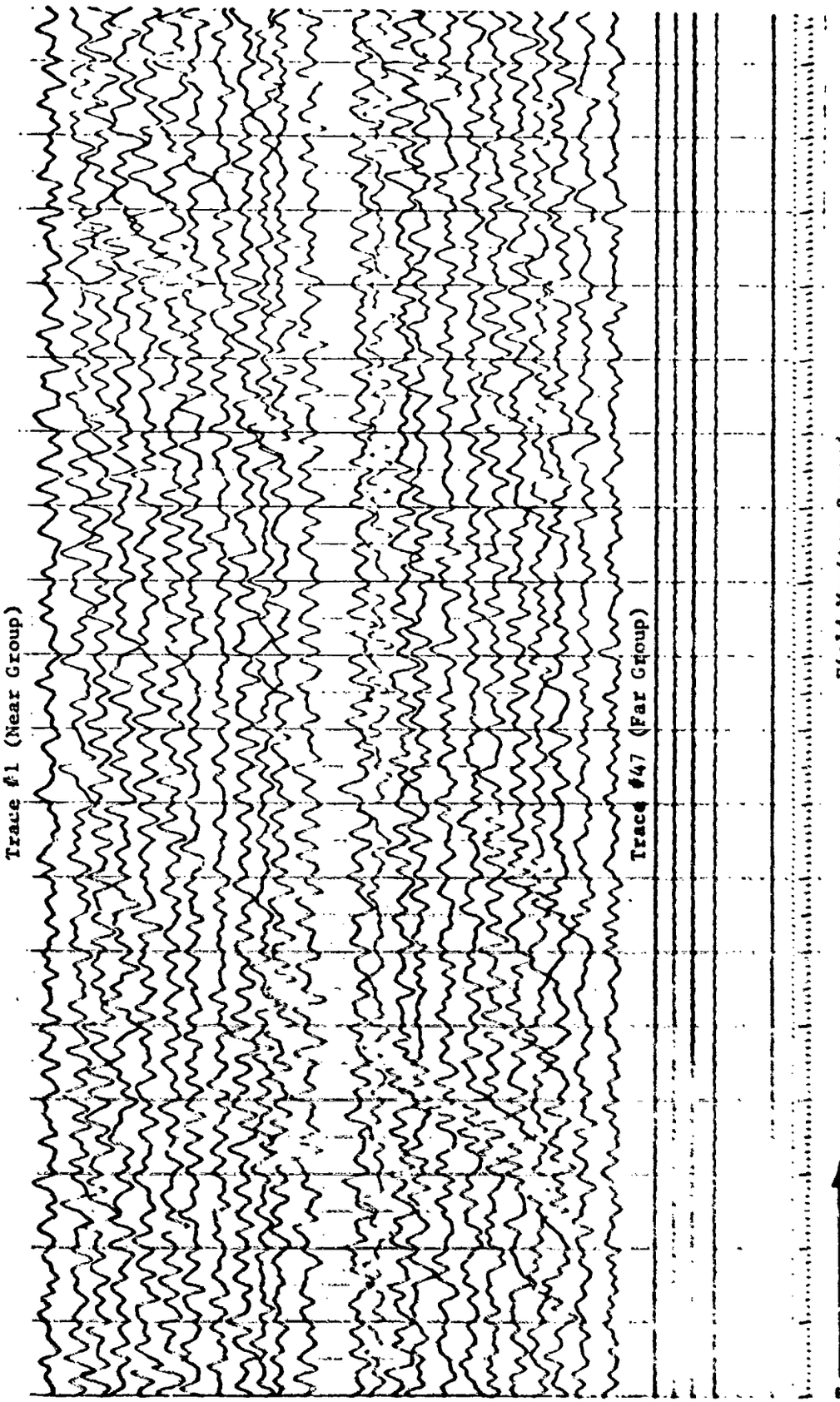
Figure 18

UNCLASSIFIED

UNCLASSIFIED

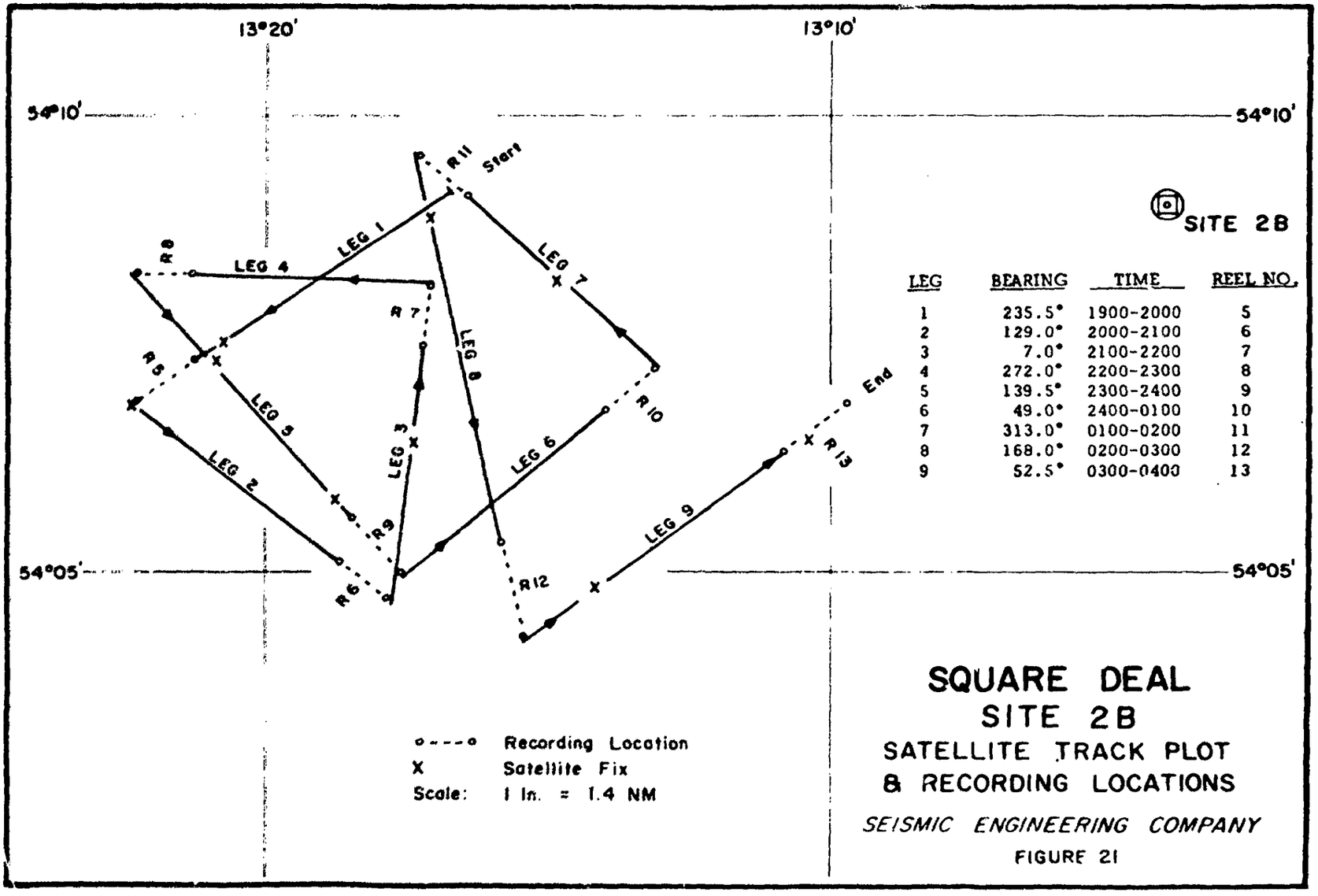


CONFIDENTIAL



Field Monitor Record
Recording #3
Site 2BC

Figure # 20



LEG	BEARING	TIME	REEL NO.
1	235.5°	1900-2000	5
2	129.0°	2000-2100	6
3	7.0°	2100-2200	7
4	272.0°	2200-2300	8
5	139.5°	2300-2400	9
6	49.0°	2400-0100	10
7	313.0°	0100-0200	11
8	168.0°	0200-0300	12
9	52.5°	0300-0400	13

SQUARE DEAL
SITE 2B
SATELLITE TRACK PLOT & RECORDING LOCATIONS

SEISMIC ENGINEERING COMPANY

FIGURE 21

CONFIDENTIAL

CONFIDENTIAL

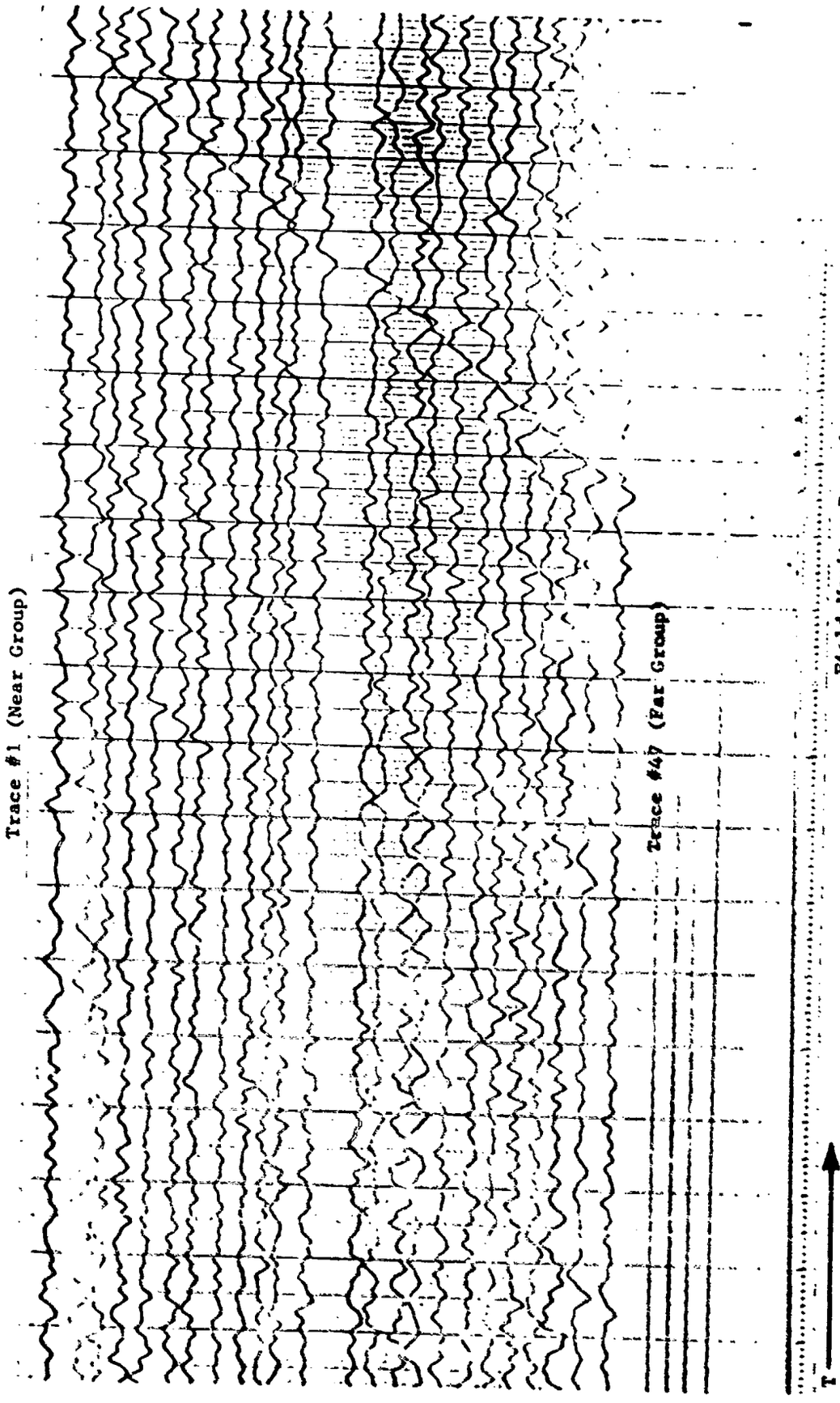

Trace #1 (Near Group)
Trace #47 (Far Group)
T
Field Monitor Record
Recording #6
Site 2B
Side #2

Figure # 22

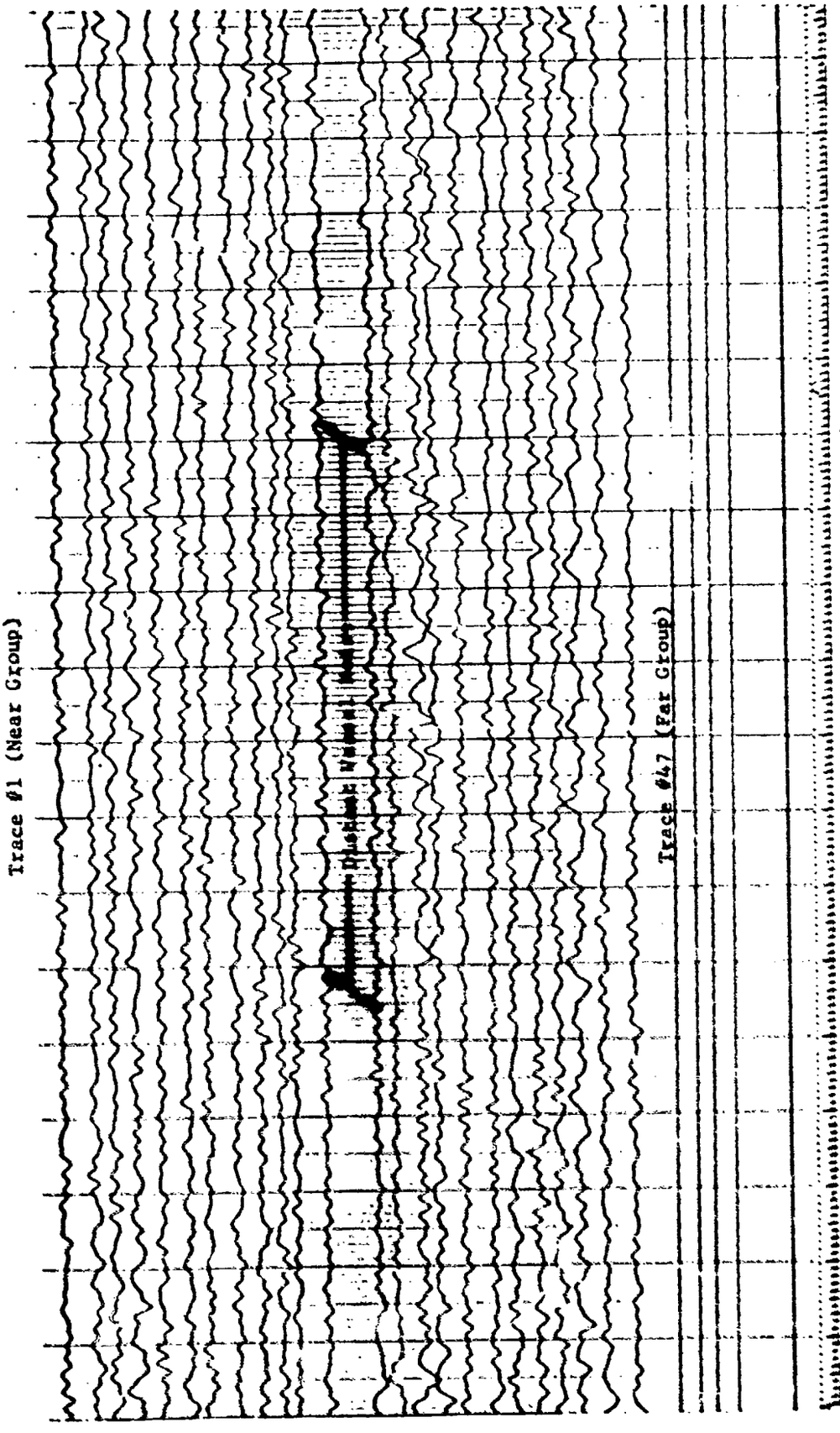
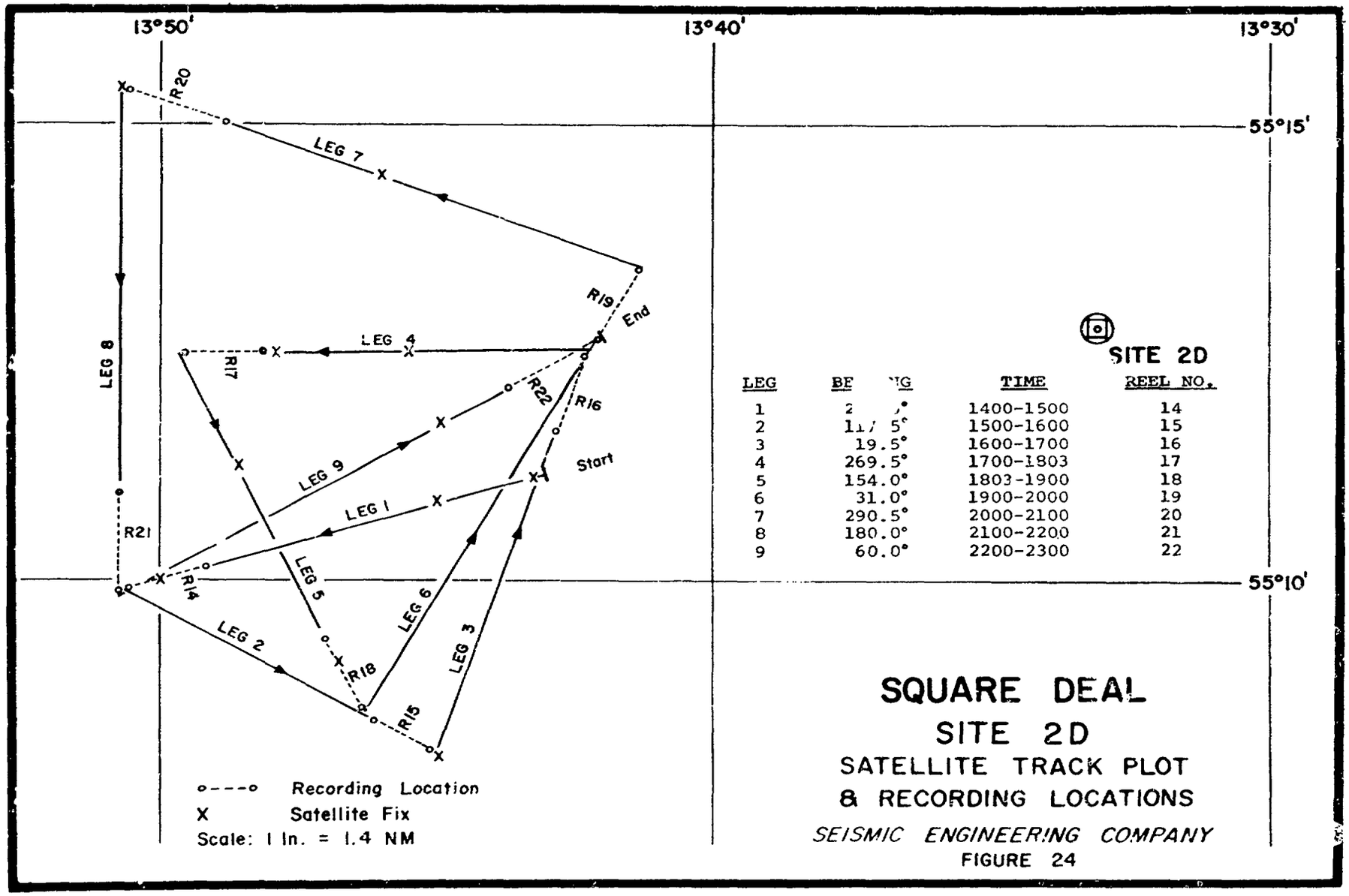

Trace #1 (Near Group)
Trace #47 (Far Group)
Field Monitor Record
Recording #5
Site 2B
Side #1
1

Figure # 23



SITE 2D

LEG	BEARING	TIME	REEL NO.
1	2 [illegible]°	1400-1500	14
2	11[illegible] 5°	1500-1600	15
3	19.5°	1600-1700	16
4	269.5°	1700-1803	17
5	154.0°	1803-1900	18
6	31.0°	1900-2000	19
7	290.5°	2000-2100	20
8	180.0°	2100-2200	21
9	60.0°	2200-2300	22

SQUARE DEAL

SITE 2D

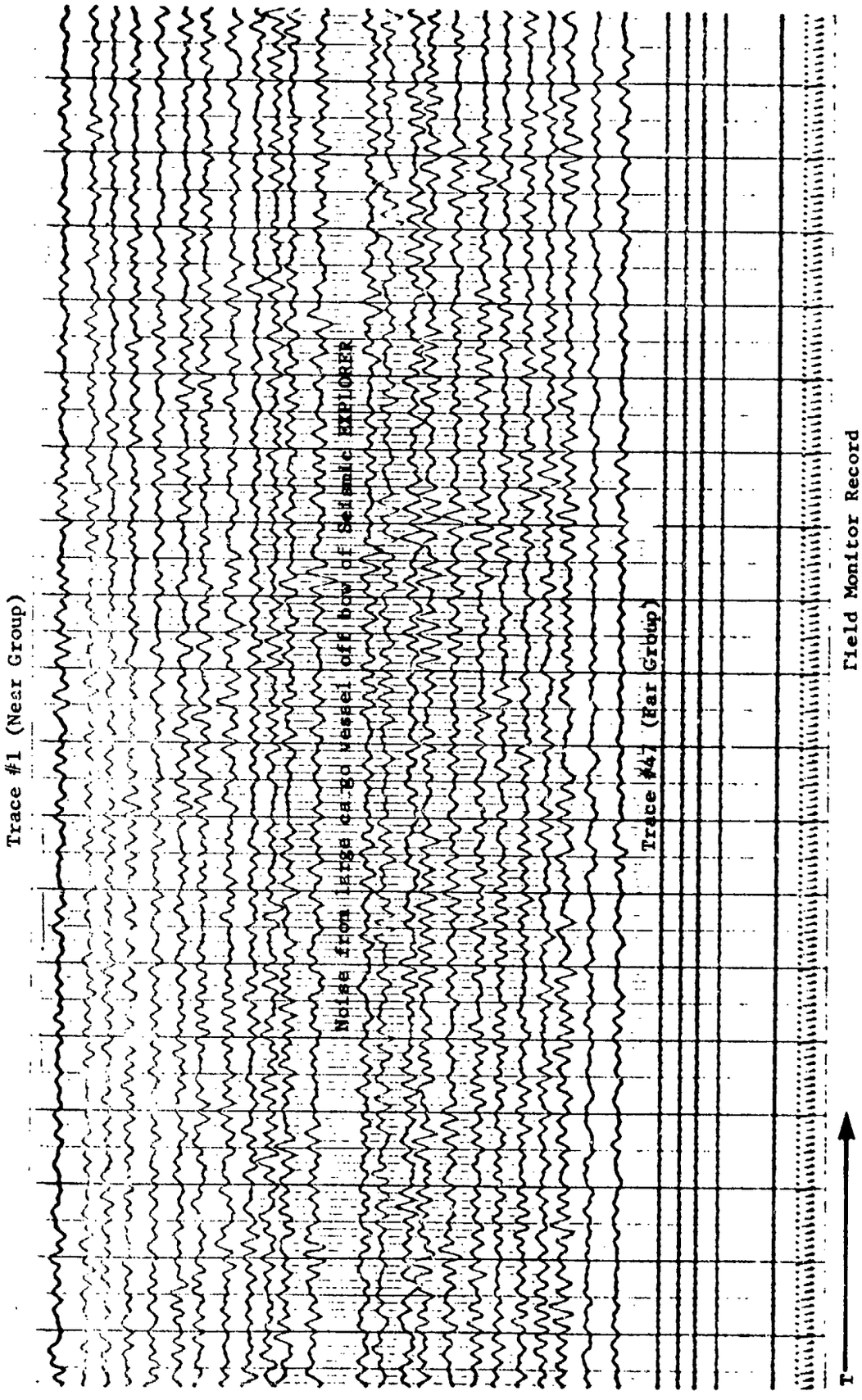
SATELLITE TRACK PLOT & RECORDING LOCATIONS

SEISMIC ENGINEERING COMPANY

FIGURE 24

CONFIDENTIAL

CONFIDENTIAL



Field Monitor Record
Recording #16
Site 2D
Side #3

Figure # 25

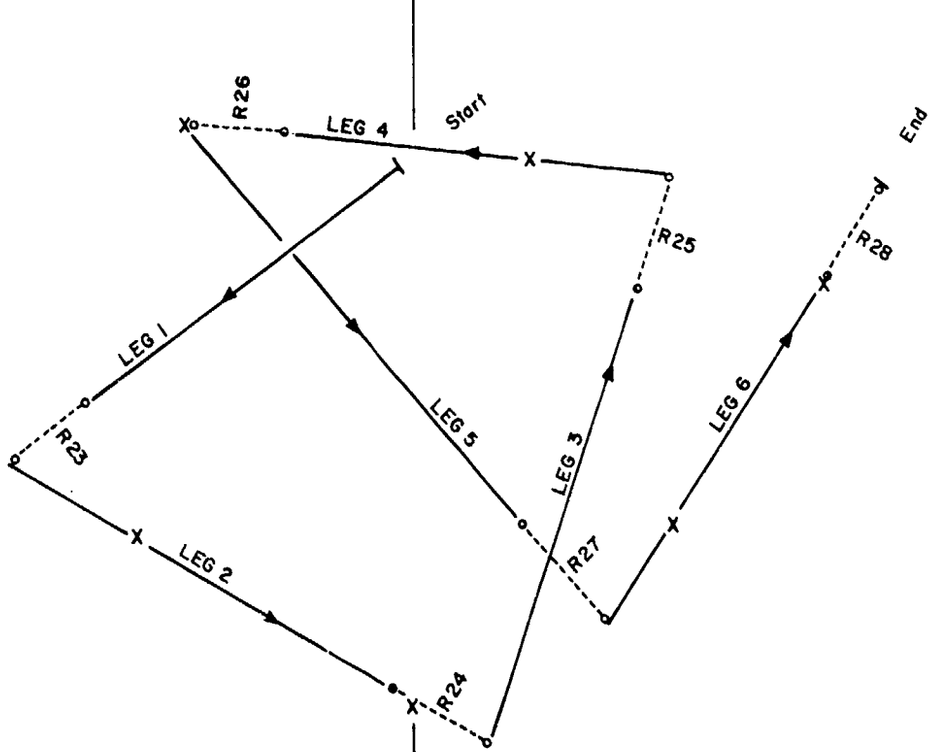
14°10'

14°00'

SITE 2A

LEG	BEARING	TIME	REEL NO.
1	234.0	1000-1100	23
2	118.5	1100-1200	24
3	19.0	1200-1307	25
4	276.0	1307-1400	26
5	138.0	1400-1500	27
6	33.5	1500-1600	28

56°10'



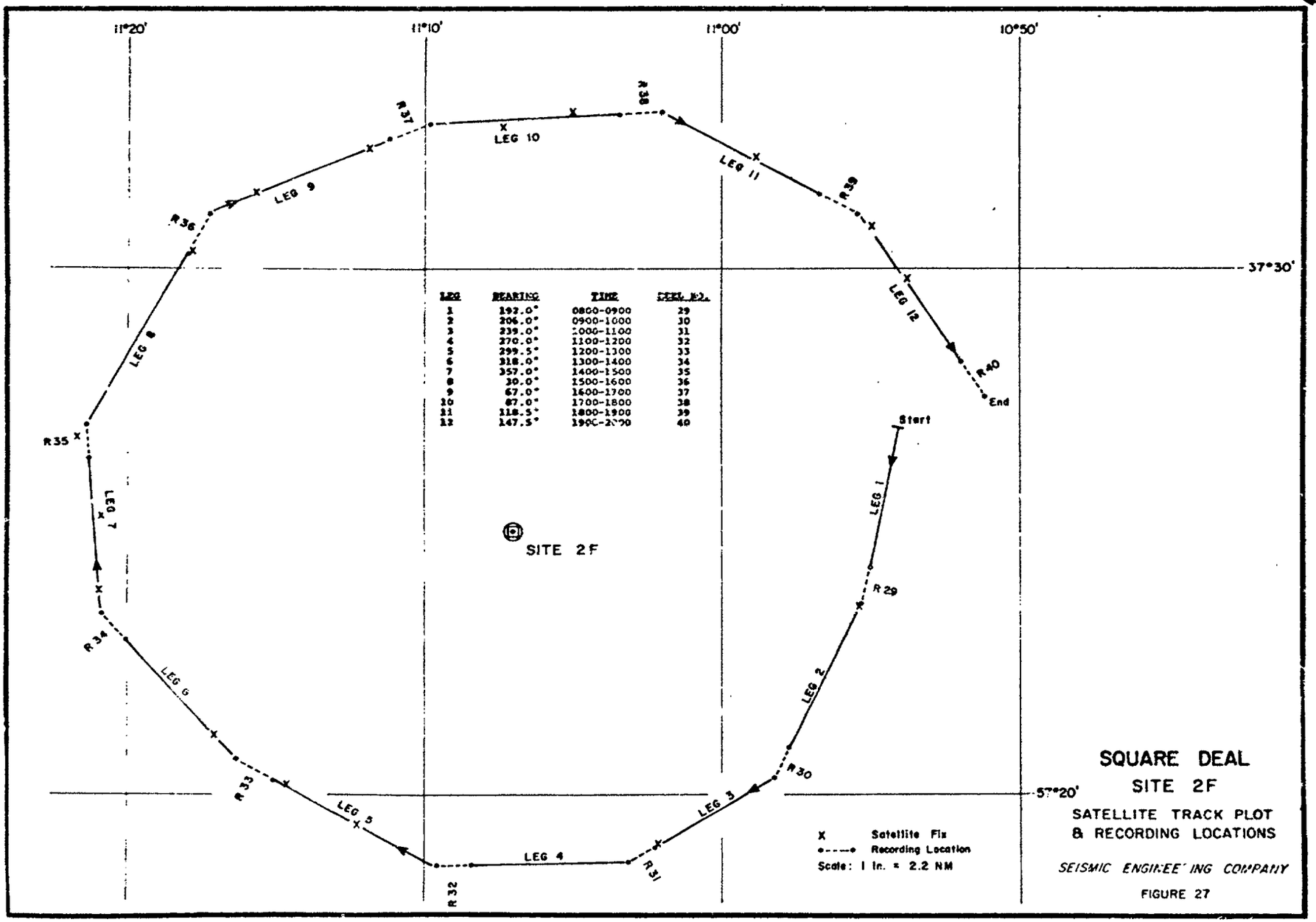
o----o Recording Location
X Satellite Fix
Scale: 1 in. = 1.4 NM

SQUARE DEAL
SITE 2A
SATELLITE TRACK PLOT & RECORDING LOCATIONS

SEISMIC ENGINEERING COMPANY

56°00'

FIGURE 26



LEG	BEARING	TIME	PEEL (R)
1	192.0°	0800-0900	29
2	206.0°	0900-1000	30
3	239.0°	1000-1100	31
4	270.0°	1100-1200	32
5	299.5°	1200-1300	33
6	318.0°	1300-1400	34
7	357.0°	1400-1500	35
8	20.0°	1500-1600	36
9	67.0°	1600-1700	37
10	87.0°	1700-1800	38
11	118.5°	1800-1900	39
12	147.5°	1900-2000	40

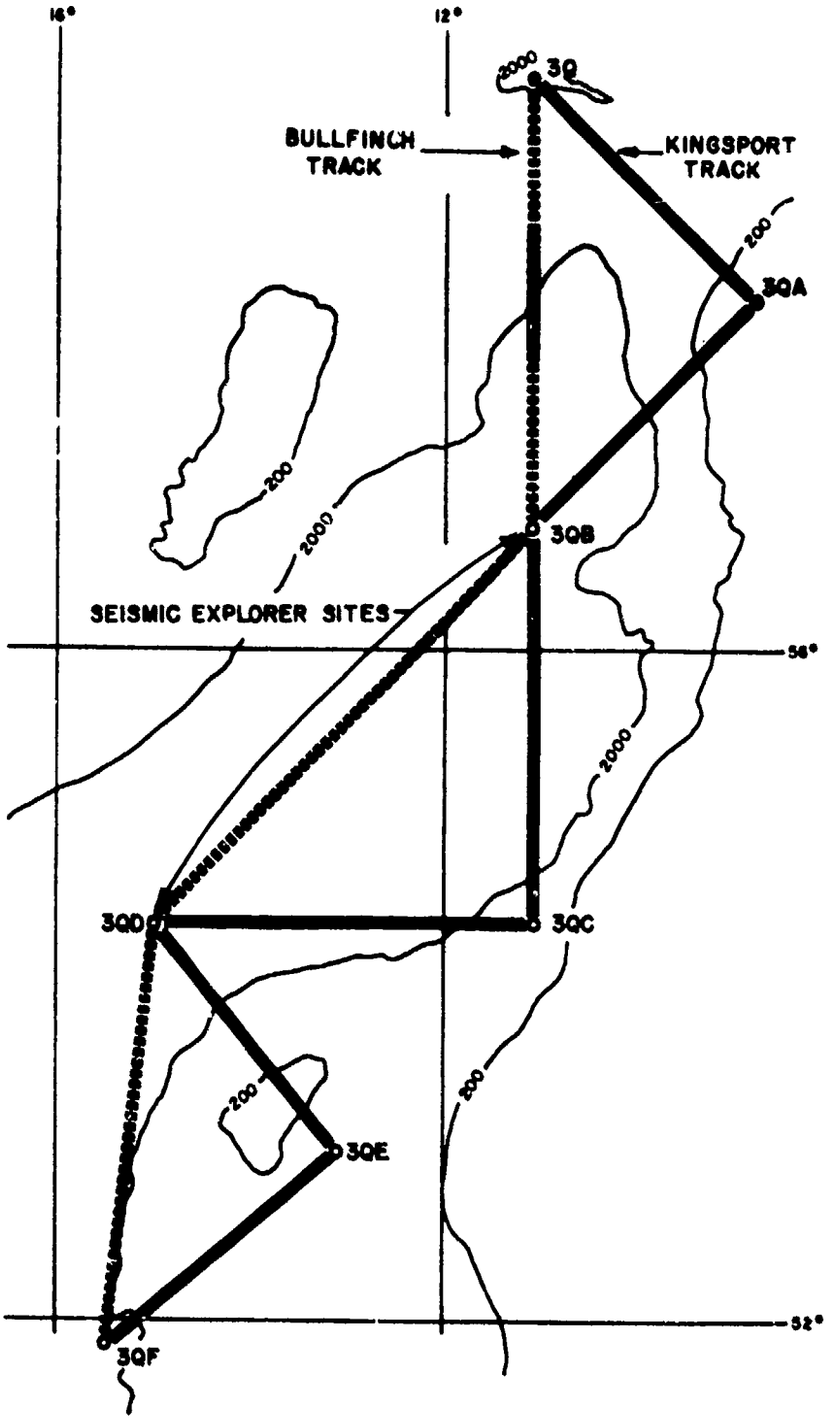
SQUARE DEAL
SITE 2F
SATELLITE TRACK PLOT & RECORDING LOCATIONS

SEISMIC ENGINEERING COMPANY

FIGURE 27

CONFIDENTIAL

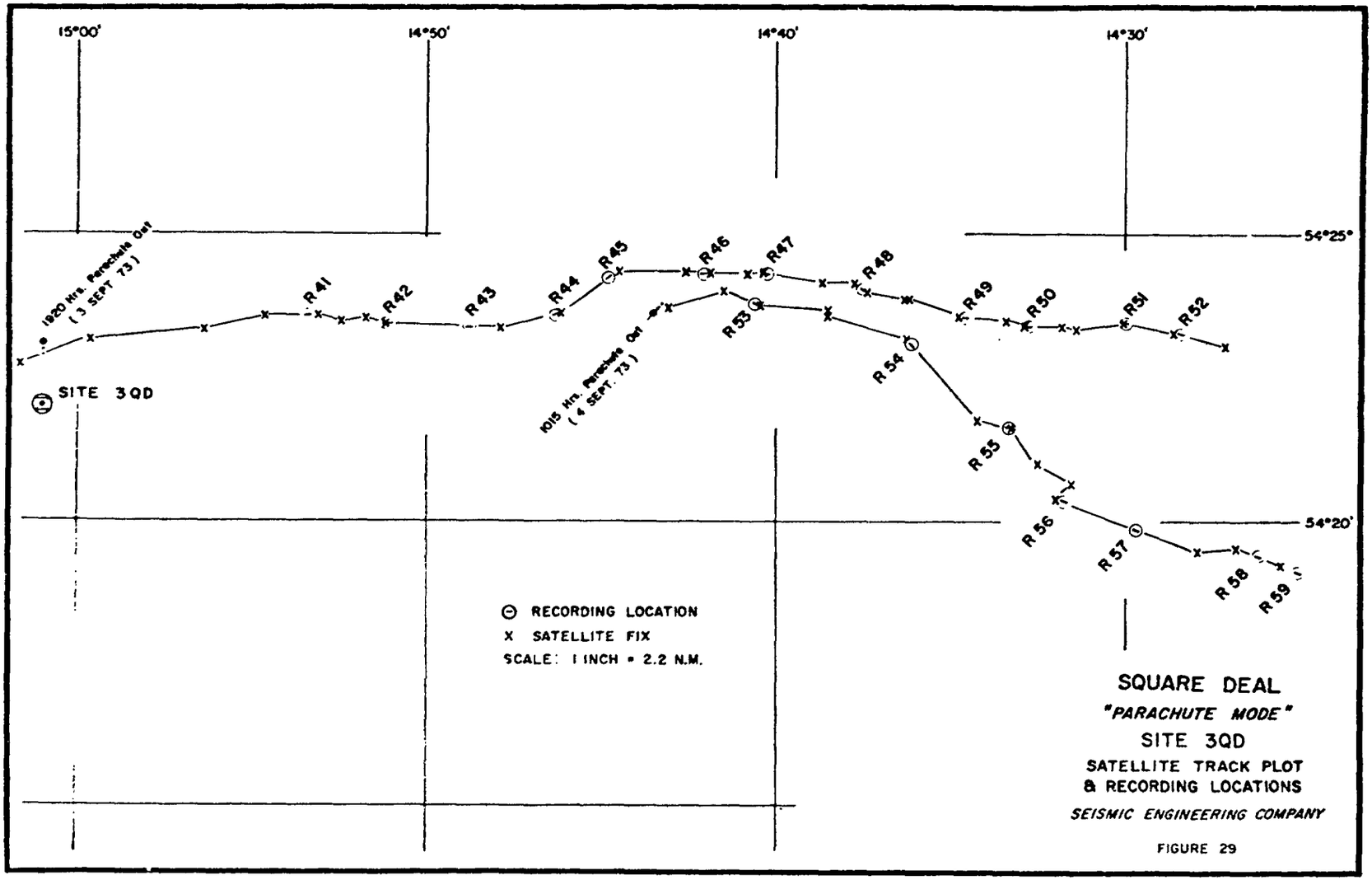
CONFIDENTIAL



SQUARE DEAL

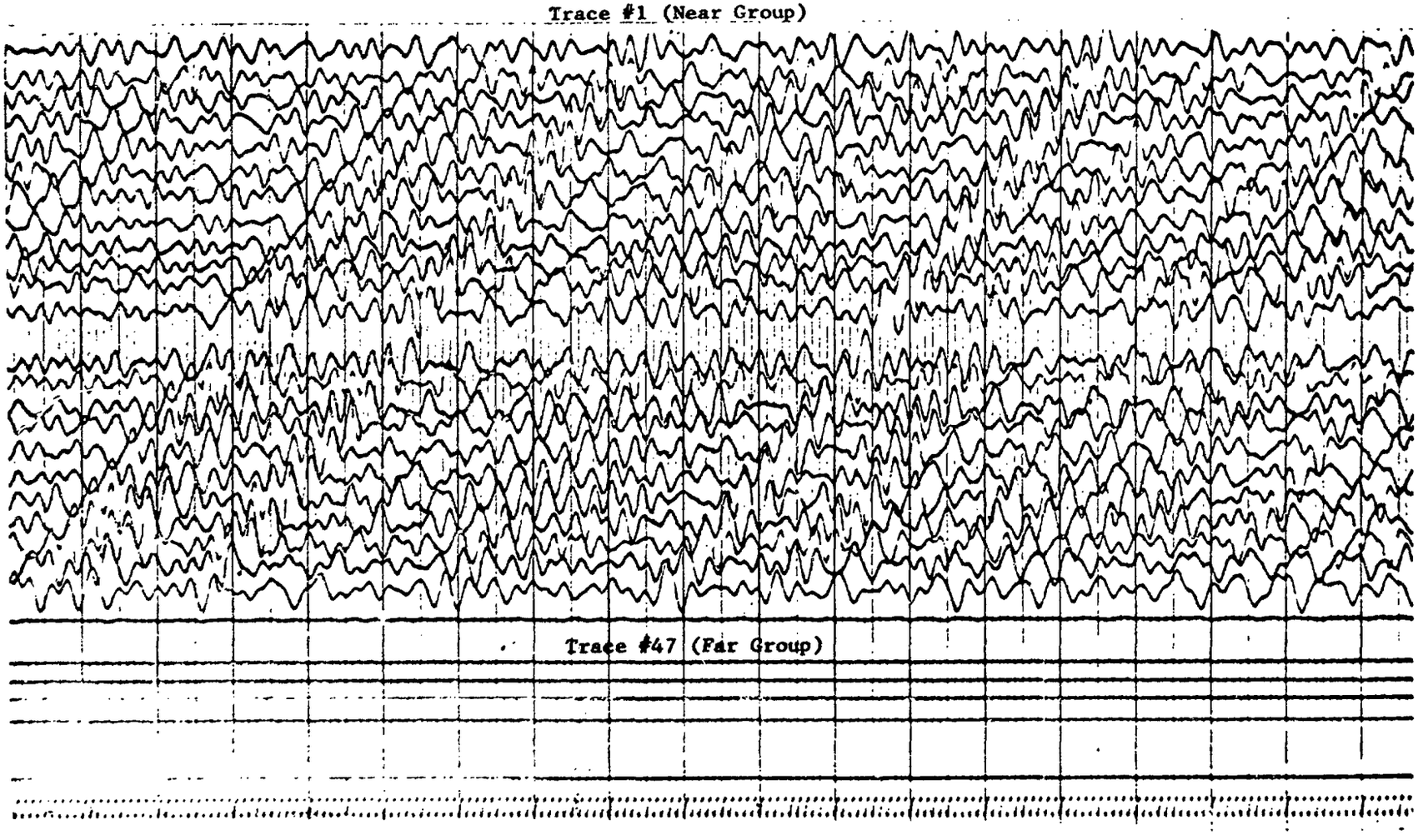
DETECTION EXPERIMENT

FIGURE 28



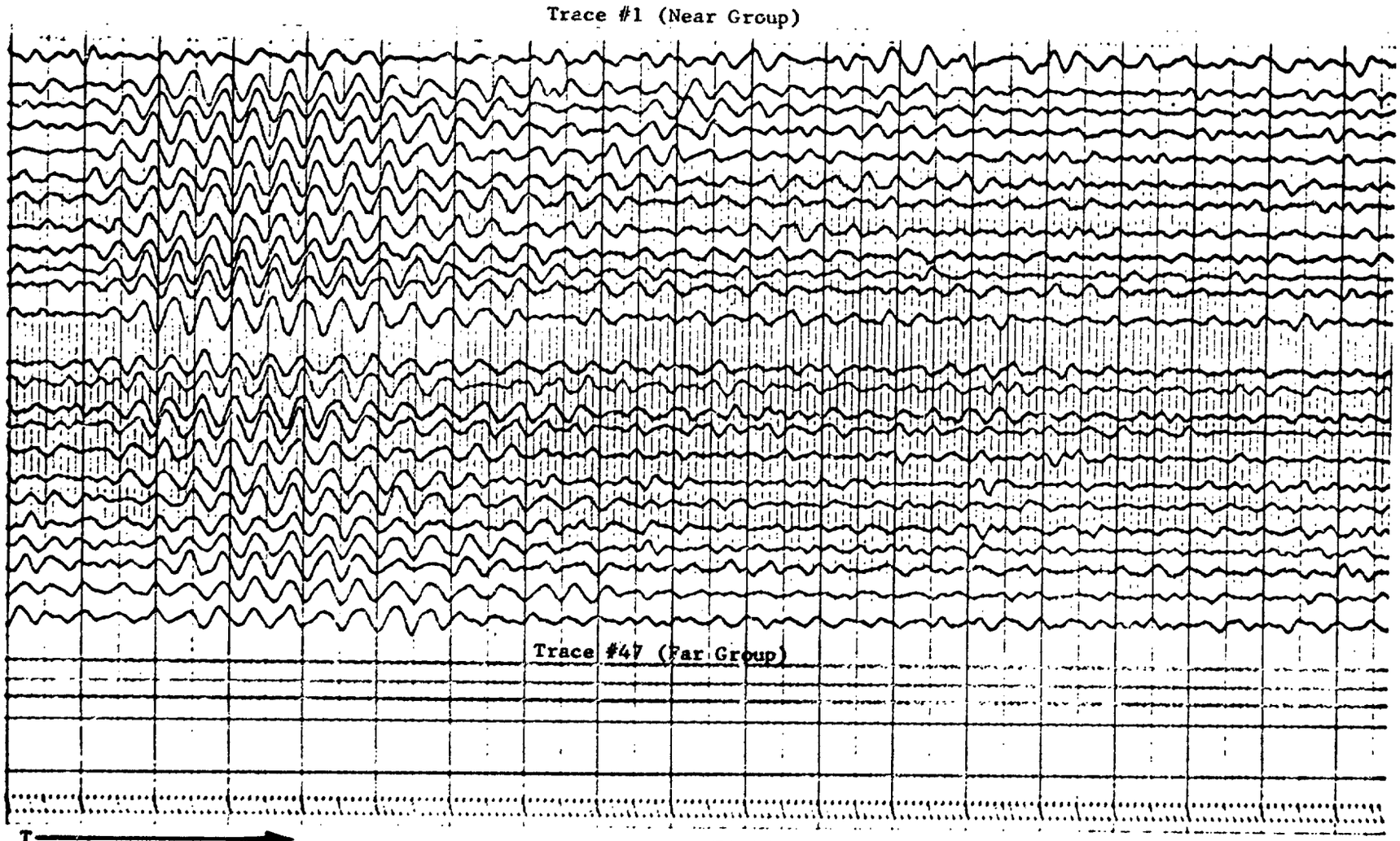
CONFIDENTIAL

CONFIDENTIAL



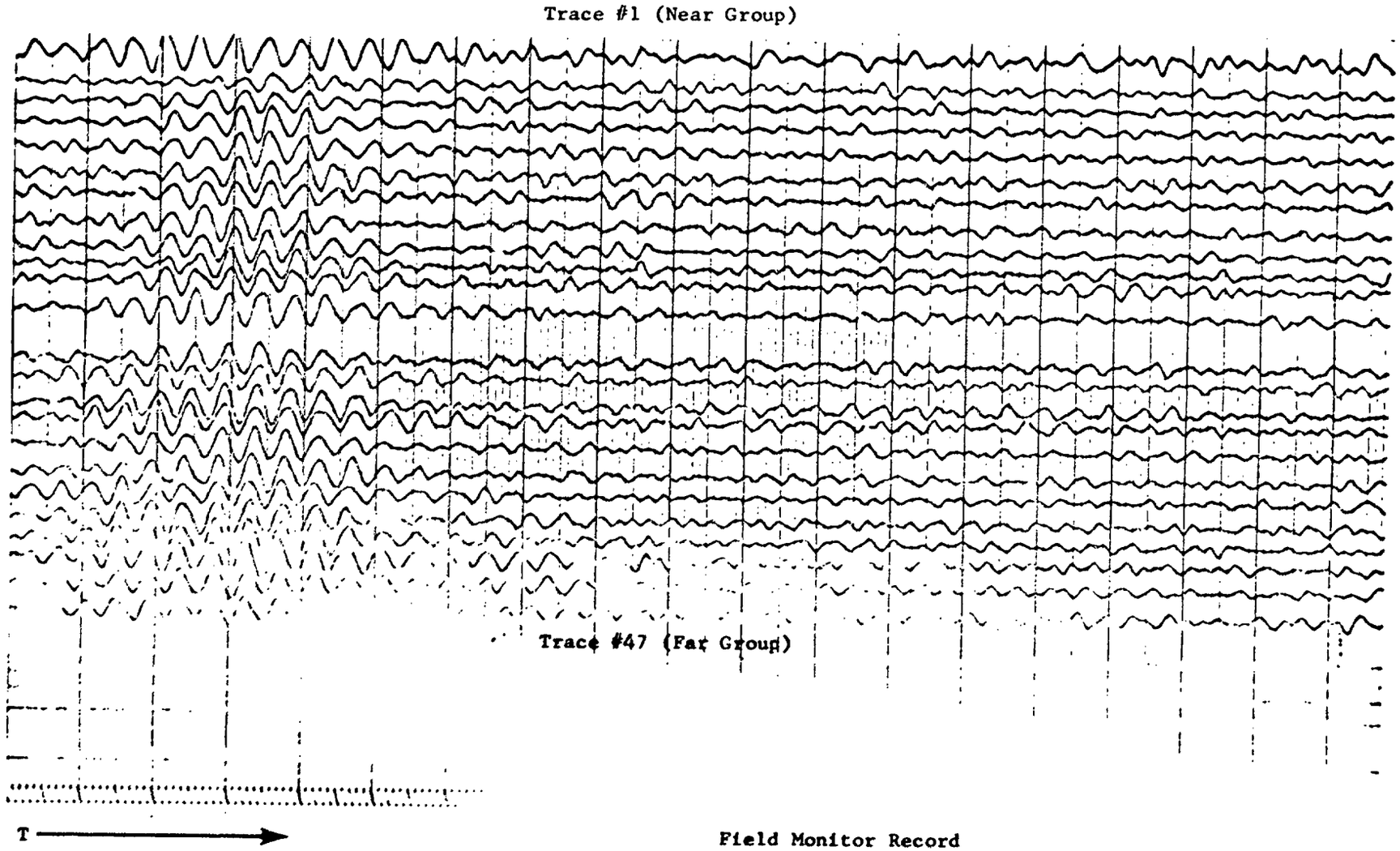
Field Monitor Record
Recording #41
Site 3QD
Parachute Mode

Figure # 30



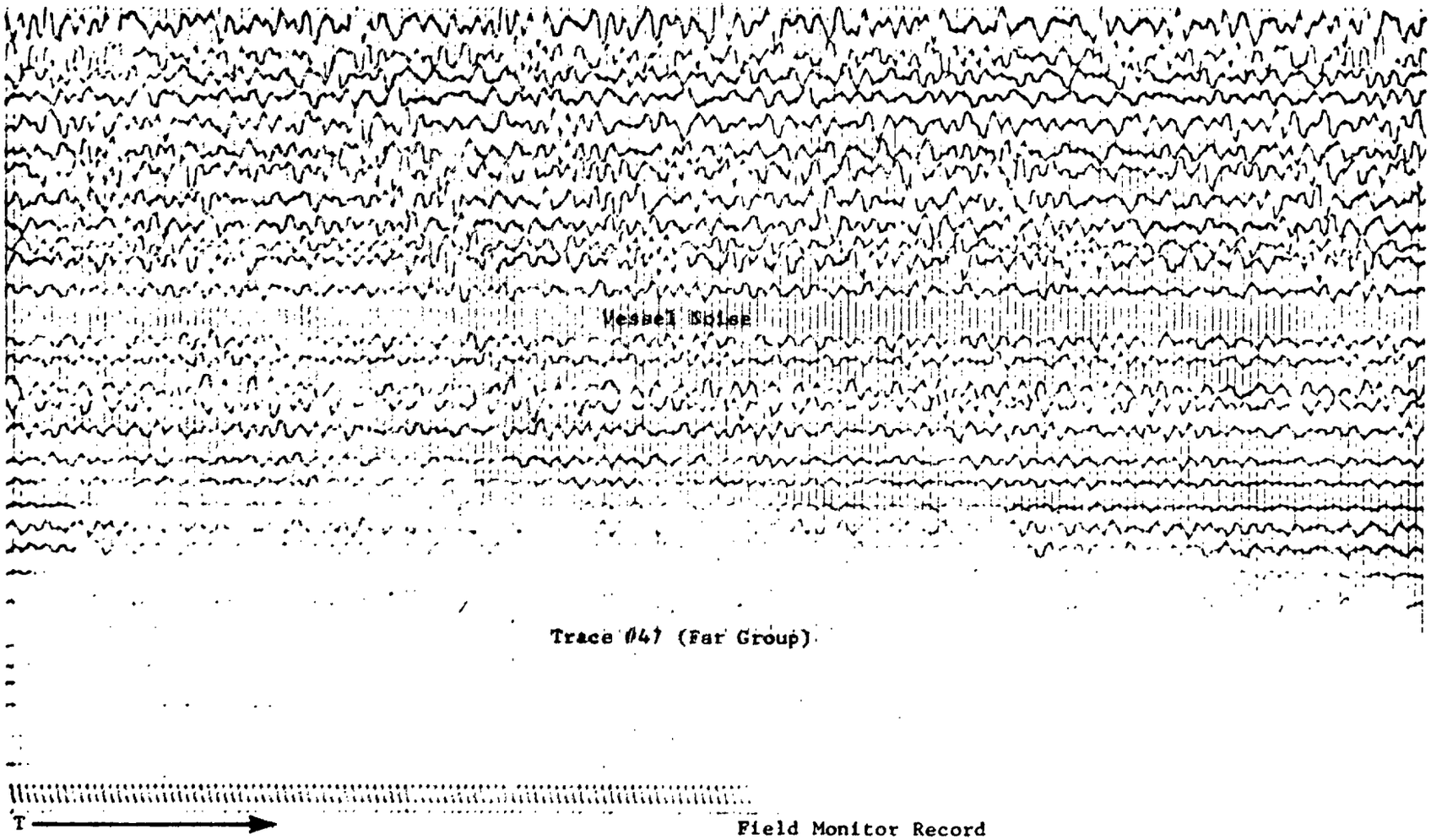
Field Monitor Record
Recording #44
Site 3QD
Parachute Mode

Figure # 31



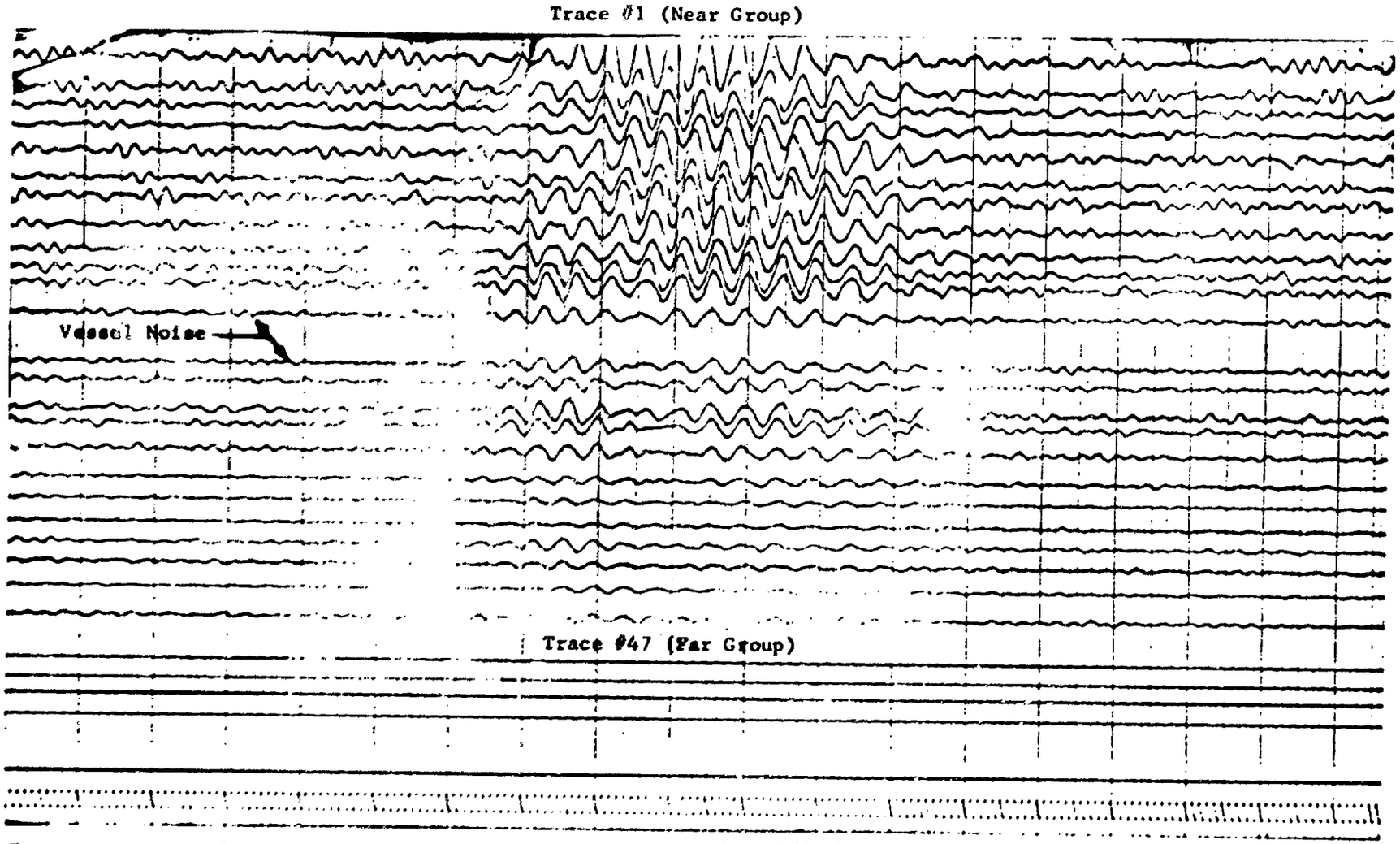
Field Monitor Record
Recording #44
Site 3QD
Parachute Mode

Figure # 32



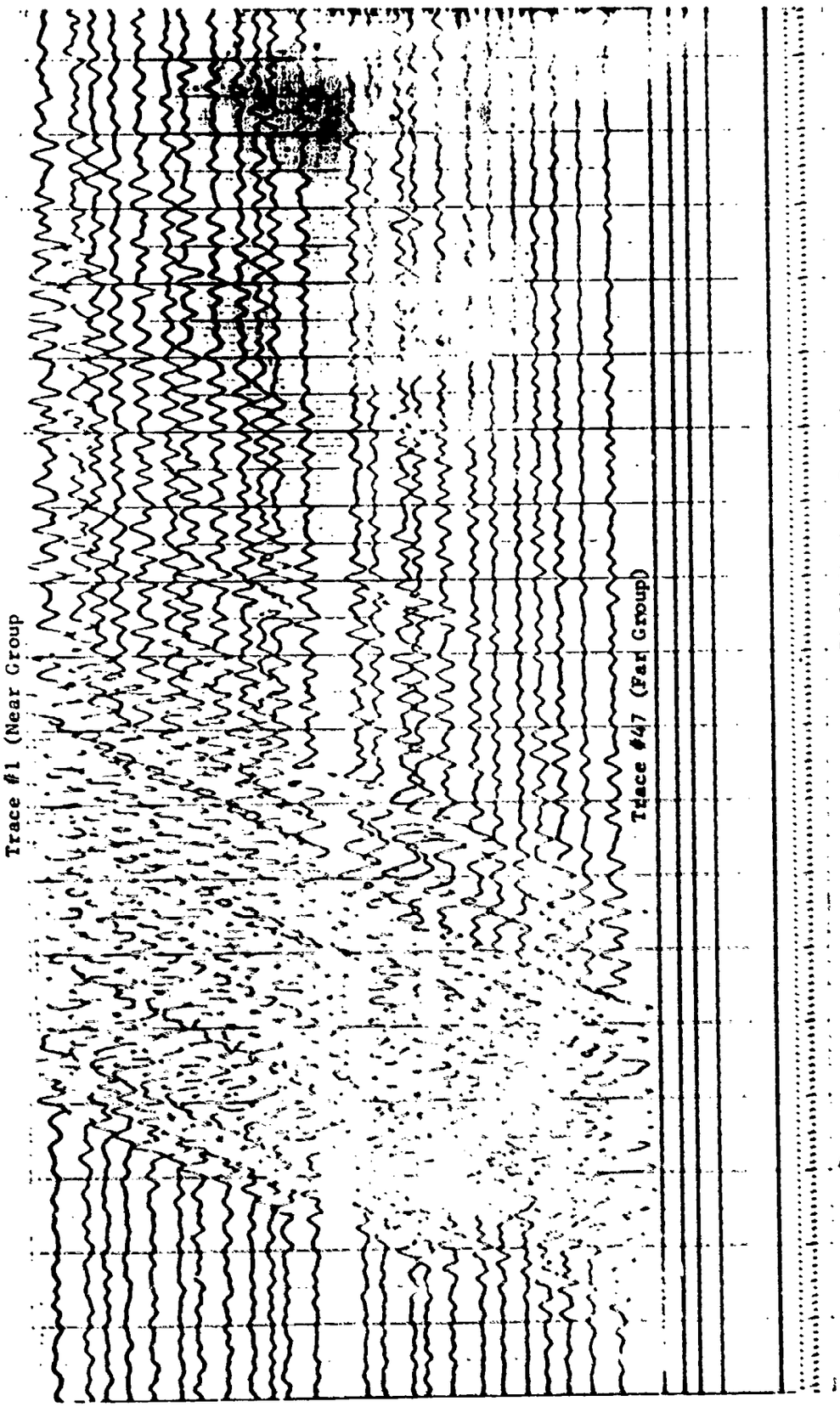
Field Monitor Record
Recording #55
Site 3QD
Parachute Mode

Figure # 33



Field Monitor Record
Recording #57
Site 3QD
Parachute Mode

Figure # 34



Field Monitor Record
Recording #59
Site 3QD
Parachute Mode

Figure #35

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SQUARE DEAL PRELIMINARY REPORT	5. TYPE OF REPORT & PERIOD COVERED Technical August - September, 1973 6. PERFORMING ORG. REPORT NUMBER H SECo #73-5
7. AUTHOR(s) W. H. Luehrmann	8. CONTRACT OR GRANT NUMBER(s) N00123-74C-0523
9. PERFORMING ORGANIZATION NAME AND ADDRESS Seismic Engineering Company 3616 W. Alabama Houston, Texas 77027	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Undersea Center South Rosecrans Street San Diego, California 92132	12. REPORT DATE November 21, 1973 13. NUMBER OF PAGES 56 plus Figures
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) CONFIDENTIAL 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE Declassified 31 Dec. 1979

16. DISTRIBUTION STATEMENT (of this Report)

In addition to security requirements which apply to this document and must be met, each transmittal outside the Department of Defense must have prior approval of Office of Naval Research.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Square Deal
Seismic towed array
Ambient Ocean Noise
R/V Seismic Explorer

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report covers the data acquisition phase of specific events of the 1973 SQUARE DEAL program of the Long Range Acoustic Propogation Progrect (LRAPP). (U)

The objective of this portion of the project is to provide information on the azimuthal dependence of low-frequency ambient noise. These data are to be acquired with a geophysical type, mult-element hydrophone array. (U)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Field operations were programmed for seven specified locations. All locations except one were occupied between 27 August and 4 September, 1973. Field monitor records obtained during recording periods indicate high quality data, and the project was completed on schedule and within budget. (U)

DISTRIBUTION LIST

SQUARE DEAL PRELIMINARY REPORT

Chief of Naval Operations
Attn: OP-951F 1
Department of the Navy
Washington D. C. 20350

Advanced Research Projects Agency
Attn: Mr. Randy Cook 1
1400 Wilson Blvd.
Arlington, Virginia 22209

Oceanographer of the Navy
Madison Building
Attn: Dr. J. Boosman 1
732 North Washington Street
Alexandria, Virginia 22314

Chief of Naval Research
Department of the Navy
Attn: Code 102-OSC 2
400 1
412 1
AESD 1
Arlington, Virginia 22217

Commander
Second Fleet 1
Norfolk, Virginia 23511

Commander in Chief
U. S. Naval Forces, Europe
FPO CTG 24.11 1
New York, New York 09510

Commander
Oceanographic Systems, Atlantic
Box 100 1
Norfolk, Virginia 23511

Defense Documentation Center
Cameron Station 2
Alexandria, Virginia 22314

Project Manager
Antisubmarine Warfare Systems
Project
Attn: ASW-11 1
Department of the Navy
Washington D. C. 20360

Commander 1
Naval Ship Systems Command
Department of the Navy
Washington D. C. 20360

Commander 1
Naval Air Systems Command
Department of the Navy
Washington D. C. 20360

Commander 1
Naval Electronic Systems
Command
Attn: PME-124 1
124T 1
124TA 1
124-40 1
124-60 1
Department of the Navy
Washington D. C. 20360

Commander
U. S. Naval Oceanographic Office
Attn: Code 6130 1
Department of the Navy
Washington D. C. 20390

Commander
Naval Undersea Center
Attn: Code 502 1
503 1
San Diego, California 92132

Director
Naval Research Laboratory
Attn: Code 8168 1
Washington D. C. 20390

Commander
Naval Underwater Systems Center
Attn: Code TA111 1
New London, Connecticut 06320

Arthur D. Little, Inc.
Attn: Dr. Gordon Raisbeck 2
Acorn Park
Cambridge, Massachusetts 02140

DISTRIBUTION LIST

SQUARE DEAL PRELIMINARY REPORT
(Cont.'d)

TRW Systems Group
Attn: Mr. J. Hess 1
7600 Coleshire Drive
McLean, Virginia 22101

Planning Systems, Inc.
Attn: Dr. L. Solomon 1
7900 Westpark Drive-Suite 507
The Honeywell Center
McLean, Virginia 22101

B-K Dynamics, Inc.
Attn: Mr. P. Bernard 1
2351 Shady Grove Road
Rockville, Maryland 20850

TRACOR, Inc.
Attn: Mr. J. Gottwald 1
1601 Research Blvd.
Rockville, Maryland 20850

Texas Instruments
Attn: Mr. A. Kirst 1
P.O. Box 6015 Mail Station
400
Dallas, Texas 75222

Raff Associates
Attn: Dr. J. Bowen 1
912 Thayer Ave.
Silver Spring, Maryland 20910

University of Miami
Attn: Dr. S. C. Daubin 1
School of Marine & Atmospheric
Sciences
10 Rickenbacker Causeway
Miami, Florida 33149

Western Electric Company
Attn: Mr. Lower 1
2400 Reynolda Road
Winston-Salem, North Carolina
27106

Tetra-Tech, Inc.
Attn: Mr. C. H. Dabney 1
1911 Fort Meyer Drive
Arlington, Virginia 22209

Xonics, Inc.
Attn: Mr. S. Kulek 1
6837 Hayvenhurst Avenue
Van Nuys, California 91406

Woods Hole Oceanographic Institution
Attn: Dr. E. E. Hays 1
Woods Hole, Massachusetts 02543

Seismic Engineering Co.
Attn: Mr. Luehrmann 2
3616 West Alabama
Houston, Texas 77027

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
875 NORTH RANDOLPH STREET
SUITE 1425
ARLINGTON VA 22203-1995

IN REPLY REFER TO:

5510/1
Ser 321OA/011/06
31 Jan 06

MEMORANDUM FOR DISTRIBUTION LIST

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

Ref: (a) SECNAVINST 5510.36

Encl: (1) List of DECLASSIFIED LRAPP Documents

1. In accordance with reference (a), a declassification review has been conducted on a number of classified LRAPP documents.

2. The LRAPP documents listed in enclosure (1) have been downgraded to UNCLASSIFIED and have been approved for public release. These documents should be remarked as follows:

   Classification changed to UNCLASSIFIED by authority of the Chief of Naval Operations (N772) letter N772A/6U875630, 20 January 2006.

   DISTRIBUTION STATEMENT A: Approved for Public Release; Distribution is unlimited.

3. Questions may be directed to the undersigned on (703) 696-4619, DSN 426-4619.

BRIAN LINK
By direction

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

DISTRIBUTION LIST:

NAVOCEANO (Code N121LC – Jaime Ratliff)
NRL Washington (Code 5596.3 – Mary Templeman)
PEO LMW Det San Diego (PMS 181)
DTIC-OCQ (Larry Downing)
ARL, U of Texas
Blue Sea Corporation (Dr.Roy Gaul)
ONR 32B (CAPT Paul Stewart)
ONR 321OA (Dr. Ellen Livingston)
APL, U of Washington
APL, Johns Hopkins University
ARL, Penn State University
MPL of Scripps Institution of Oceanography
WHOI
NAVSEA
NAVAIR
NUWC
SAIC

Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
ARLTR7952	Focke, K. C., et al.	CHURCH STROKE 2 CRUISE 5 PAR/ACODAC ENVIRONMENTAL ACOUSTIC MEASUREMENTS AND ANALYSIS (U)	University of Texas, Applied Research Laboratories	791029	ADC025102; NS; AU; ND	C
Unavailable	Van Wyckhouse, R. J.	SYNBAPS. VOLUME I. DATA BASE SOURCES AND DATA PREPARATION	Naval Ocean R&D Activity	791201	ADC025193	C
NORDATN63	Brunson, B. A., et al.	ENVIRONMENTAL EFFECTS ON LOW FREQUENCY TRANSMISSION LOSS IN THE GULF OF MEXICO (U)	Naval Ocean R&D Activity	800901	ADC029543; ND	C
NORDATN80C	Gereben, I. B.	ACOUSTIC SIGNAL CHARACTERISTICS MEASURED WITH THE LAMBDA III DURING CHURCH STROKE III (U)	Naval Ocean R&D Activity	800915	ADC023527; NS; AU; ND	C
NOSCTR664	Gordon, D. F.	ARRAY SIMULATION AT THE BEARING STAKE SITES	Naval Ocean Systems Center	810401	ADC025992; NS; AU; ND	C
NOSCTR703	Gordon, D. F.	NORMAL MODE ANALYSIS OF PROPAGATION LOSS AT THE BEARING STAKE SITES (U)	Naval Ocean Systems Center	810801	ADC026872; NS; AU; ND	C
NOSCTR680	Neubert, J. A.	COHERENCE VARIABILITY OF ARRAYS DURING BEARING STAKE (U)	Naval Ocean Systems Center	810801	ADC028075; NS; ND	C
HSECO735	Luehrmann, W. H.	SQUARE DEAL R/V SEISMIC EXPLORER FIELD OPERATIONS REPORT (U)	Seismic Engineering Co.	731121	AD0530744; NS; ND	C; U
MPL-C-42/76	Morris, G. B.	CHURCH ANCHOR EXPLOSIVE SOURCE (SUS) PROPAGATION MEASUREMENTS FROM R/P FLIP (U)	Marine Physical Laboratory	760701	ADC010072; AU; ND	C; U
ARLTR7637	Mitchell, S. K., et al.	SQUARE DEAL EXPLOSIVE SOURCE (SUS) PROPAGATION MEASUREMENTS. (U)	University of Texas, Applied Research Laboratories	760719	ADC014196; NS; AU; ND	C; U
NORDAR23	Fenner, D. F.	SOUND SPEED STRUCTURE OF THE NORTHEAST ATLANTIC OCEAN IN SUMMER 1973 DURING THE	Naval Ocean R&D Activity	800301	ADC029546; NS; ND	C; U
NOOTR230	Bucca, P. J.	SOUND VELOCITY CONDITIONS DURING THE CHURCH ANCHOR EXERCISE (U)	Naval Oceanographic Office	751201	NS; AU; ND	C;U
ONR SP 2-69; MC PLAN-01	Unavailable	PARKA II EXPERIMENT UTILIZING SEA SPIDER, ONR SCIENTIFIC PLAN 2-69 (U)	Maury Center for Ocean Science	690626	ADB020846; ND	U
Unavailable	Unavailable	PARKA I EXPERIMENT	Maury Center for Ocean Science	691101	AD0506209	U
USRD CR 3105	Unavailable	SEA SPIDER TRANSPONDER TRANSDUCER	Naval Research Laboratory	700505	ND	U
MC PLAN 05; ONR Scientific Plan 1-71	Unavailable	ATLANTIC TEST BED MEASUREMENT PROGRAM (U)	Maury Center for Ocean Science	701020	ND	U
ACR-170 VOL.1	Hurdle, B. G.	PROJECT NEAT- A COLLABORATIVE LONG RANGE PROPAGATION EXPERIMENT IN THE NORTHEAST ATLANTIC, PART I (U)	Naval Research Laboratory	701118	ND	U
MC-003-VOL-2	Unavailable	THE PARKA I EXPERIMENT. APPENDICES- PACIFIC ACOUSTIC RESEARCH KANEOHE-ALASKA (U)	Maury Center for Ocean Science	710101	ND	U